VUKSIC,L. ~~and Others~~ a

"Some Problems of the Epidemiology of Exanthematous Typhus in Sandzak, Bosnia, and Hercegovina in the Years 1951-1952." p. 23. (Vojnosanitetski Pregled, Military-Medical Review, Vol. 10, no. 1/2, Jan/Feb. 1953. Beograd)

SO: Monthly List of East European Accessions, Vol. 3, no. 3. Library of Congress. March 1954. Uncl.

VUKSIC, L.J.; MORELJ, M.; ZDRAVKOVIC, A.; MILOJCIC, B.

A plan for the prevention of communicable diseases in Serbia.
Higijena 15 no.1/2:16-34 '63.

VUKSIC, Ljubomir, puk.dr

Migration of the civilian population during the war. Bibl.Hig.inst Srbije, no.5:180-194 '54.

1. Katedra na higijeny i epidemiologiju Vojno-medicinske akademije JNA.

(WAR,
migration of civilian population during war)
(TRANSIENTS AND MIGRANTS,
migration of civilian population during war)

VUKSIC, Lj.; ARSIC, B.; MEL, D.; MORELJ, M.; GERBEC, M.; MILOVANOVIC, M.; STOJKOVIC, Lj.; MIRKOVIC, M.; MILIVOJEVIC, M.

Isolation of Coxiella burnetti from stable dust. Higijena, Beogr. 8 no.4:240-245 1956.

1. Katedra za Higijenu i epidemiologiju VMA. Virusolonko odeljenje Higijenskog instituta NRS, Beograd.

(COXIELLA BURNETTI,
isolation from stable dust (Ser))

(DUST,
isolation of Coxiella burnetti from stable dust (Ser))

MORELJ, Marijan; GERBEC, Mirko; VUKIC, Ljubomir; MAL, David

Q fever; isolation of Coxiella burnetti from sheep placenta. [illegible]
nan. progl., Beogr. 14 no.5:255-260 May 57.

1. Katedra za higijenu i epidemiologiju VMA Epidemiološki i mikrobiološki institut.
(Q FEVER, microbiol.
isolation of Coxiella burnetti from sheep placenta [illegible]
(SHEEP
same)

VUKSIC, Ljubomir, sanitetski [illegible] dr.; ARSIC, Bogoljub, sanitetski pukovnik [illegible] dr.; [illegible] Marijan, general-major sanitetske sluzbe [illegible]

Development of the military epidemiologic doctrine on dysentery in the Yugoslav National Army. Vojnosanit. pregl. 22 no.6:365-370 Je '65.

1. Vojnomedicinska akademija u Beogradu, Higienski zavod, Epidemicloski institut.

MORELJ, Marjan, general-major sanitetske sluzbe profesor dr.; ANDELKOVIC, Dragana, dr.; VUKSIC, Ljubomir, sanitetski pukovnik profesor dr.

Some epidemiologic aspects of diarrheal diseases in Yugoslavia. Vojnosanit. pregl. 22 no.6:371-380 Je '65.

1. Vojnomedicinska akademija u Beogradu, Higijenski zavod, Epidemioloski institut, Savezni zavod za zdravstvenu zastitu.

VUKSIC, Ljubomir, sanitetski pukovnik, prof. dr.; JOVANOVIC, Tihomir, sanitetski major, dr.; NIKOLIC, Bozidar, sanitetski potpukovnik, dr.

Sterilization of syringes by boiling for the TABT vaccination in the Yugoslavian Army and its influence on infectious hepatitits. Vojnosanit. pregl. 21 no.5:344-349 My '64

1. Vojnomedicinska akademija u Beogradu.

BIRTASEVIC, Bozidar, sanitetski major, dr.; BICAKCIC, Halim, sanitetski pukovnik, dr.; VUKSIC , Ljubomir, sanitetski pukovnik profesor, dr.

Explosive epidemic of inoculation hepatitis. Vojnosanit. pregl. 21 no.5:322-325 My '64

VUKSIC, Ljubomir, sanitetski pukovnik, prof.dr.

A method for teaching military epidemiology. Vojnosanit. pr[illegible] 20 no.9:577-585 S '63.

S

VUKSICH,

YUGOSLAVIA/Virology - Human and Animal Viruses. E-3

Abs Jour : Ref Zhur - Biol., No 4, 1958, 14613

Author : Vuksich, Arsich, Mel, Morel, Gerbets, Milovanovich, Stoykovich, Mirokovich, Milivoevich.

Inst : -

Title : Isolation of Coxiella Burneti From Dust of Sheep Corrals.

Orig Pub : Higijena, 1956, 8, No 4, 240-245

Abstract : No abstract.

Card 1/1

USCOMM-DC-55, 112

VUKSIC, L.J.

Contribution to the geographic distribution of Q fever in Yugoslavia.
Higijena, Beogr. 12 no.2/3:165-177 '60.
(Q FEVER epidemiol)

ZAPESOCHNYY, I.P. [Zapesochnyi, I.P.]; ZHUKOV, I.G. [Zhukov, I.H.]; GARGA, I.I. [Harha, I.I.]; VUKSTYCH, V.S. [Vukstych, V.S.]

Apparatus with a vacuum monochromator for studying optical excitation functions. Ukr. Fiz. zhur. 9 no. 2:196-206 F '64 (MIRA 17:7)

1. Uzhgorodskiy gosudarstvennyy universitet.

ACCESSION NR: AP4017398 S/0185/64/009/002/0196/0206

AUTHOR: Zapisochny*y, I. P.; Zhukov, I. G.; Garga, I. I.; Vuksty*ch, V. S.

TITLE: Vacuum monochromator for the investigation of optical excitation functions

SOURCE: Ukrayins'ky*y fizy*chny*y zhurnal, v. 9, no. 2, 1964, 196-206

TOPIC TAGS: vacuum ultraviolet, vacuum ultraviolet spectroscopy, resonance level excitation cross-section, excitation cross-section, resonance radiation, ultraviolet monochromator, vacuum monochromator, electron beam excitation tube, mercury resonance lines

ABSTRACT: There are practically no data at present on the effective excitation cross sections of resonance levels of atoms, diatomic molecules and their ions of various multiplicity, owing to experimental difficulties in the vacuum ultraviolet region of the spectrum.

To obtain such data the authors have constructed a spectrophotometric set-up, consisting of three basic units: a vacuum monochromator of normal incidence with a one-metre (600 lines/mm) standard concave diffraction grating;

Card 1/4

ACCESSION NR: AP4017398

highly monoenergeric electron beam excitation tubes; an electrophotometer using a secondary electronic multiplier (SEM) in a pulse counting regime for recording radiation in the vacuum ultraviolet region.

The monochromator was designed so that the refraction grating and rigidly attached input and output slits are always on the Rowland circumference. Transmission of movement in the vacuum is accomplished through bellows, while the kinematic system ensures linearity of the graduated graph throughout the working region (800-3500 A).

The luminous vertical gas column in the excitation tube may be precisely set on the input slit under control of a distance gauge consisting of two telescopes, for which the possibility of moving part of the monochromator housing from the input slit is provided. This permits the maximum utilization of the light power of the monochromator (the loss in resolving power is negligible, since the intervals between the spectral lines are considerable for most objects).

The open type SEM, together with the voltage divider and the cathode repeater are located directly behind the output slit of the monochromator in a special shell. The pulse count is taken with the aid of a standard "Tulip" velocity meter.

Card 2/4

ACCESSION NR: AP4017398

The block diagram and the external appearance of the spectrophotometric set-up are shown in the appended drawings.

In conclusion, tentative data are given on the excitation functions of mercury lines λ=1850 Å (Hg I) and λ=1942 Å (Hg II).

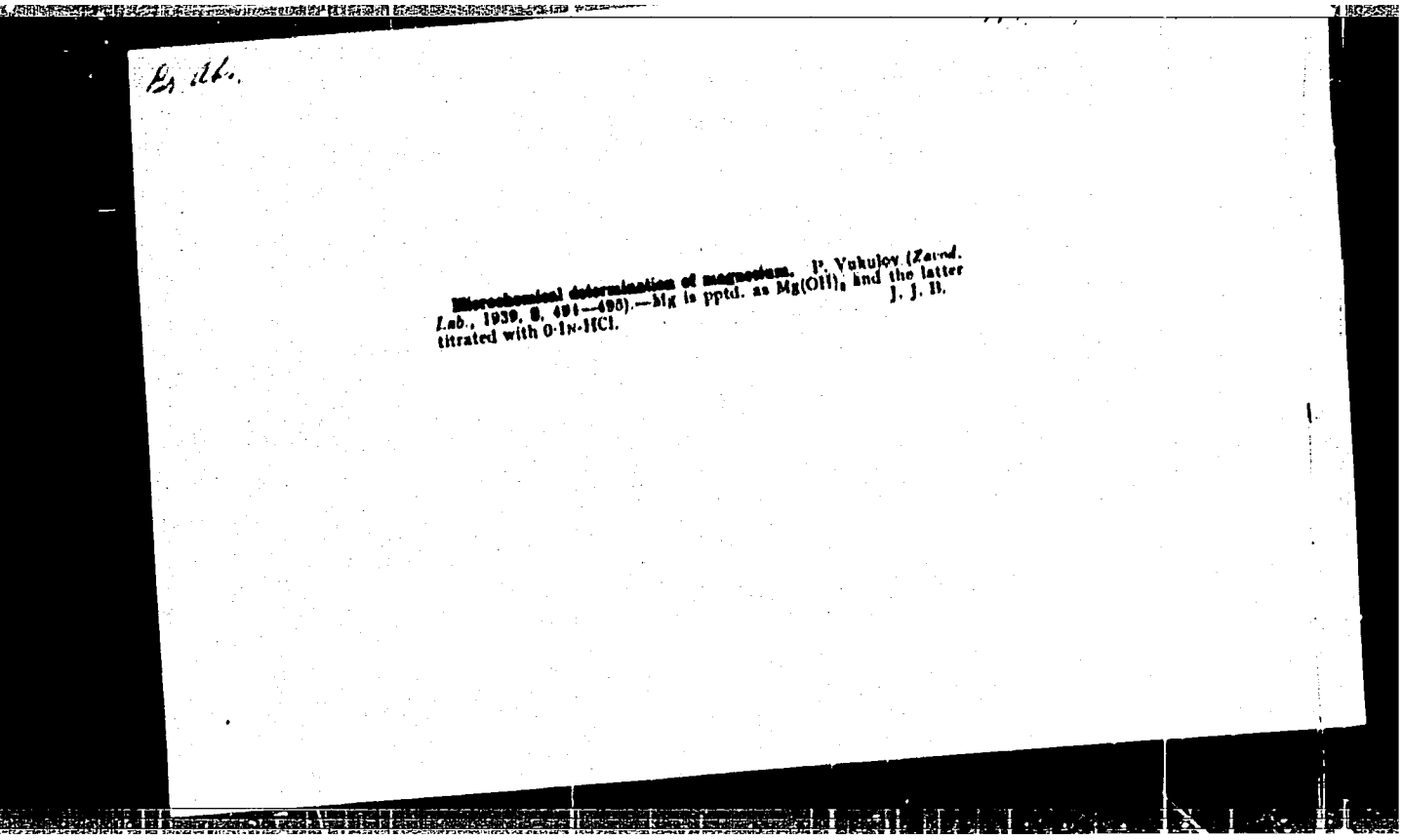
Orig. Art. has 10 figures including several schematics and block diamgrams

ASSOCIATION: Uzhgorods'ky*y Derzhuniversy*tet (Uzhgorod State University)

SUBMITTED: 11Jul63 DATE ACQ: 19Mar64 ENCL: 01

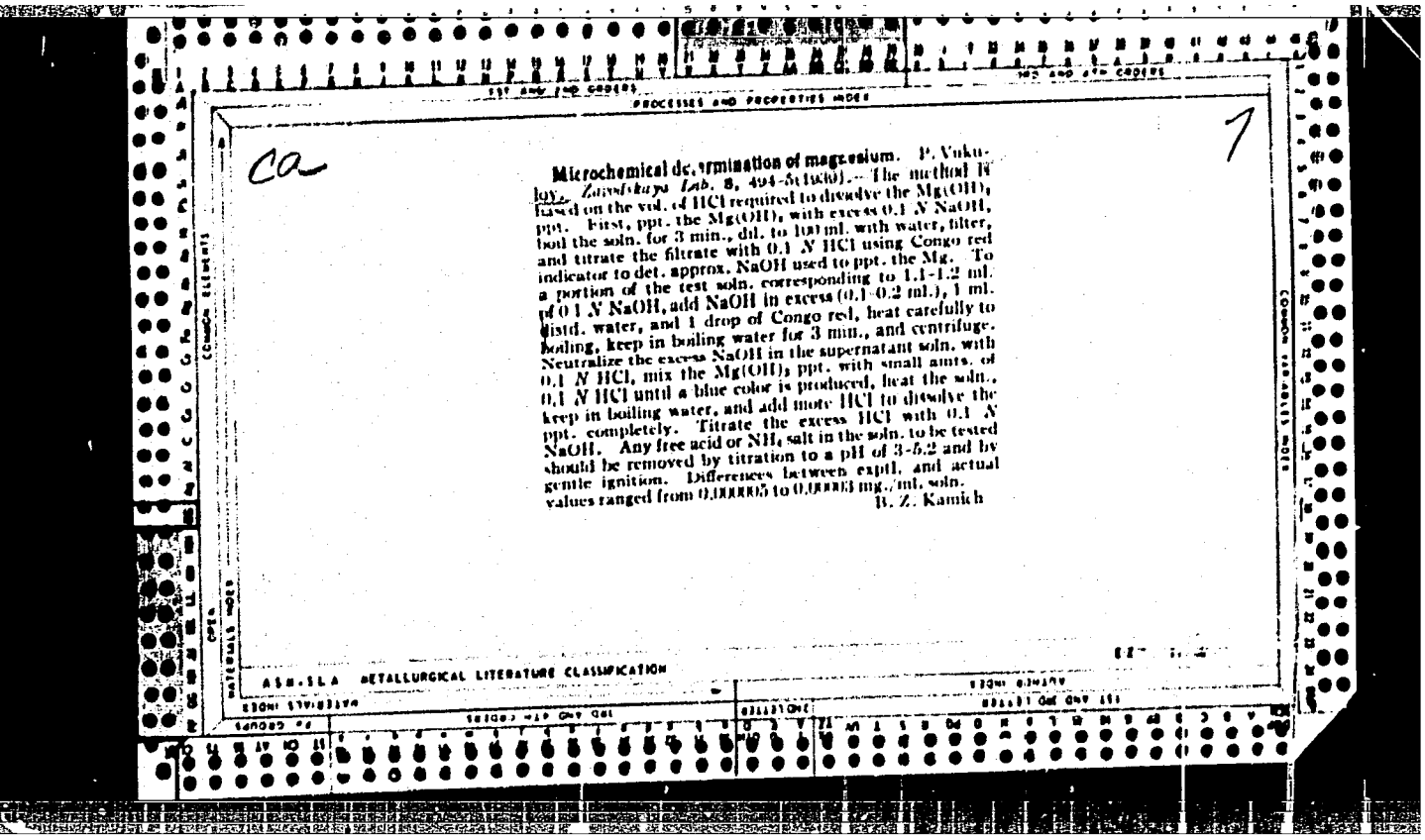
SUB CODE: PH, SD NO REF SOV: 009 OTHER: 002

Card 3/4



By Mk.

Microchemical determination of magnesium. P. Yakuljov (*Zavod. Lab.*, 1939, **8**, 494—496).—Mg is ppt'd. as $Mg(OH)_2$ and the latter titrated with 0·1N-HCl. J. J. B.

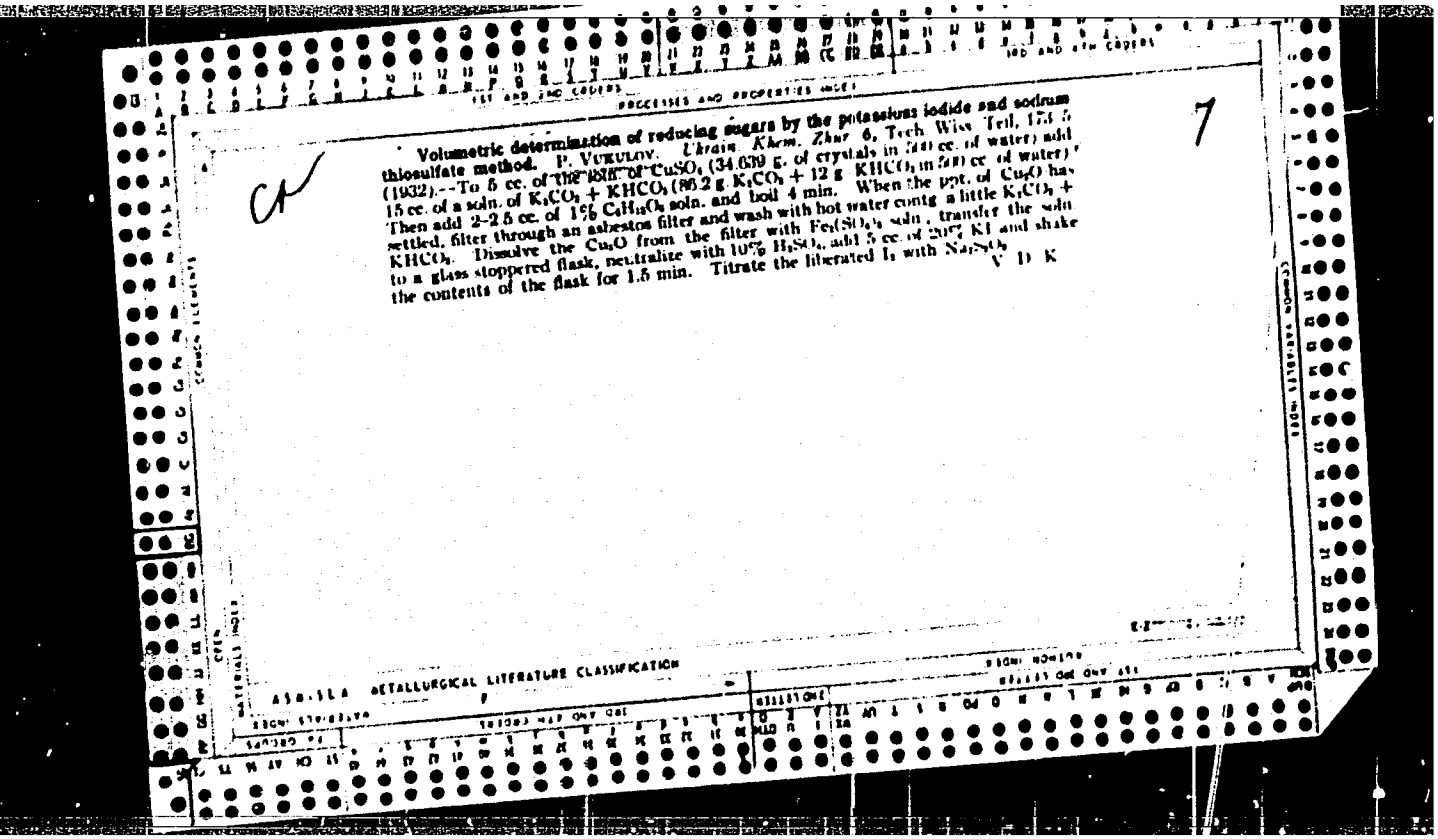


Ca

1

Microchemical determination of magnesium. P. Yuku-lov. *Zavodskaya Lab.* 8, 494-5(1939).— The method is based on the vol. of HCl required to dissolve the $Mg(OH)_2$ ppt. First, ppt. the $Mg(OH)_2$ with excess 0.1 *N* NaOH, boil the soln. for 3 min., dil. to 100 ml. with water, filter, and titrate the filtrate with 0.1 *N* HCl using Congo red indicator to det. approx. NaOH used to ppt. the Mg. To a portion of the test soln. corresponding to 1.1-1.2 ml. of 0.1 *N* NaOH, add NaOH in excess (0.1-0.2 ml.), 1 ml. distd. water, and 1 drop of Congo red, heat carefully to boiling, keep in boiling water for 3 min., and centrifuge. Neutralize the excess NaOH in the supernatant soln. with 0.1 *N* HCl, mix the $Mg(OH)_2$ ppt. with small amts. of 0.1 *N* HCl until a blue color is produced, heat the soln., keep in boiling water, and add more HCl to dissolve the ppt. completely. Titrate the excess HCl with 0.1 *N* NaOH. Any free acid or NH_4 salt in the soln. to be tested should be removed by titration to a pH of 3-5.2 and by gentle ignition. Differences between expil. and actual values ranged from 0.000005 to 0.00003 mg./ml. soln.

B. Z. Kamich



Volumetric determination of reducing sugars by the potassium iodide and sodium thiosulfate method. P. Vukulov. *Ukrain. Khem. Zhur.* 6, Tech. Wiss. Teil, 175-9 (1932).--To 5 cc. of the diln. of $CuSO_4$ (34.639 g. of crystals in 200 cc. of water) add 15 cc. of a soln. of K_2CO_3 + $KHCO_3$ (86.2 g. K_2CO_3 + 12 g. $KHCO_3$ in 200 cc. of water). Then add 2-2.5 cc. of 1% $C_6H_{12}O_6$ soln. and boil 4 min. When the ppt. of Cu_2O has settled, filter through an asbestos filter and wash with hot water contg. a little K_2CO_3 + $KHCO_3$. Dissolve the Cu_2O from the filter with $Fe_2(SO_4)_3$ soln., transfer the soln. to a glass stoppered flask, neutralize with 10% H_2SO_4, add 5 cc. of 20% KI and shake the contents of the flask for 1.5 min. Titrate the liberated I_2 with $Na_2S_2O_3$.

V. D. K.

VUKUROV, Stanislav; PAVLOVIC, Dejan

Unusual variation of thoraco-abdominal injury. Srpski arh. celok. lek. 85 no.3:355-358 Mar 57.

1. I Hirurska klinika Medicinskog fakulteta u Beogradu. Upravnik; prof. dr. Bogdan Kosanovic.

(THORAX, wds. & inj.
thoracoabdominal caused by shot wd., surg. (Ser))
(ABDOMEN, wds. & inj.
same)

VUKUROV, Stanislav; SIMIC, Petar

Disinsertion of the long head of the biceps brachii muscle.
Srpski arh. celok. lek. 85 no.4:476-480 Apr 57.

1. I Hirurska klinika Medicinskog fakulteta u Beogradu.
(Upravnik: prof. dr. Bogdan Kosanovic).
(ARM, musc. & tendons
disinsertion of long head of biceps brachii (Ser))

AUTHORS: Vul', A.A., Eydel'man, L.A., Engineers SOV-117-58-8-14/28

TITLE: The Cutting of Pipes by Turning Rollers (Rezaniye trub vrashchayushchimisya rolikami)

PERIODICAL: Mashinostroitel', 1958, Nr 8, pp 33-34 (USSR)

ABSTRACT: Turning disc rollers (Figure 1) are used for cutting copper and copper-nickel pipes in order to avoid losses of material. The rollers are made from steel R9, R18, or from the alloyed steel KhVG. The roller is held in a special holder. The pipe is fastened by a pneumatic clamp chuck. The speed of cutting is 160 m/min. The new method increases the productivity 2.5 times. Losses of material have been cut; in every ton of cut pipes, 215 kg of metal are saved.
There are 3 diagrams.

1. Cutting tools - Performance 2. Copper pipes - Cutting
3. Copper-nickel pipes - Cutting

Card 1/1

VUL, A.I., starshiy inzh.; BAZYLOV, K.B.

Engineering department of the Karaganda Post Office.
Vest. sviazi 22 no.1:20 Ja '62. (MIRA 14:12)

1. Pochtovoye upravleniye Ministerstva svyazi Kazakhskoy SSR (for Vul).

(Karaganda---Postal service)

VUL, A.I.; GUZKO, A.G.

Engineering office of the Alma-Ata post office. Vest. sviazi 21 no.4:15 Ap '61. (MIRA 14:6)

1. Nachal'nik laboratorii Alma-Atinskogo pochtamta (for Vul).
2. Nachal'nik tekhnicheskogo kabineta Alma-Atinskogo pochtamta (for Guzko).

(Alma-Ata--Post service)

PALIY, A.M.; ANTSUPOV, P.V.; VUL', A.M.; OVCHAROV, S.M.

Recent data on the gas potential of the ternary sediments of the southeastern part of the outer zone of the Carpathian piedmont fault. Neft. i gaz. prom. no.4:6-9 O-D '64
(MIRA 18:2)

L 02936-67 EWT(d)/EWT(l) EEC(k)-2/T IJP(c) BB/GG

ACC NR: AP6033213 SOURCE CODE: UR/0142/66/009/004/0428/0435

AUTHOR: Vul', V. A.

59
B

ORG: none

TITLE: A tunnel diode memory cell for radio-frequency pulses

SOURCE: IVUZ. Radiotekhnika, v. 9, no. 4, 1966, 428-435

TOPIC TAGS: computer memory, computer storage device, tunnel diode

ABSTRACT: A tunnel diode storage cell has been developed in which the two states (ZERO or ONE) are defined by the presence or absence of a high-frequency output

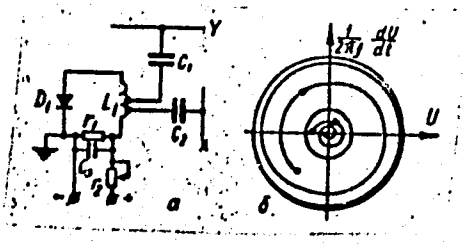
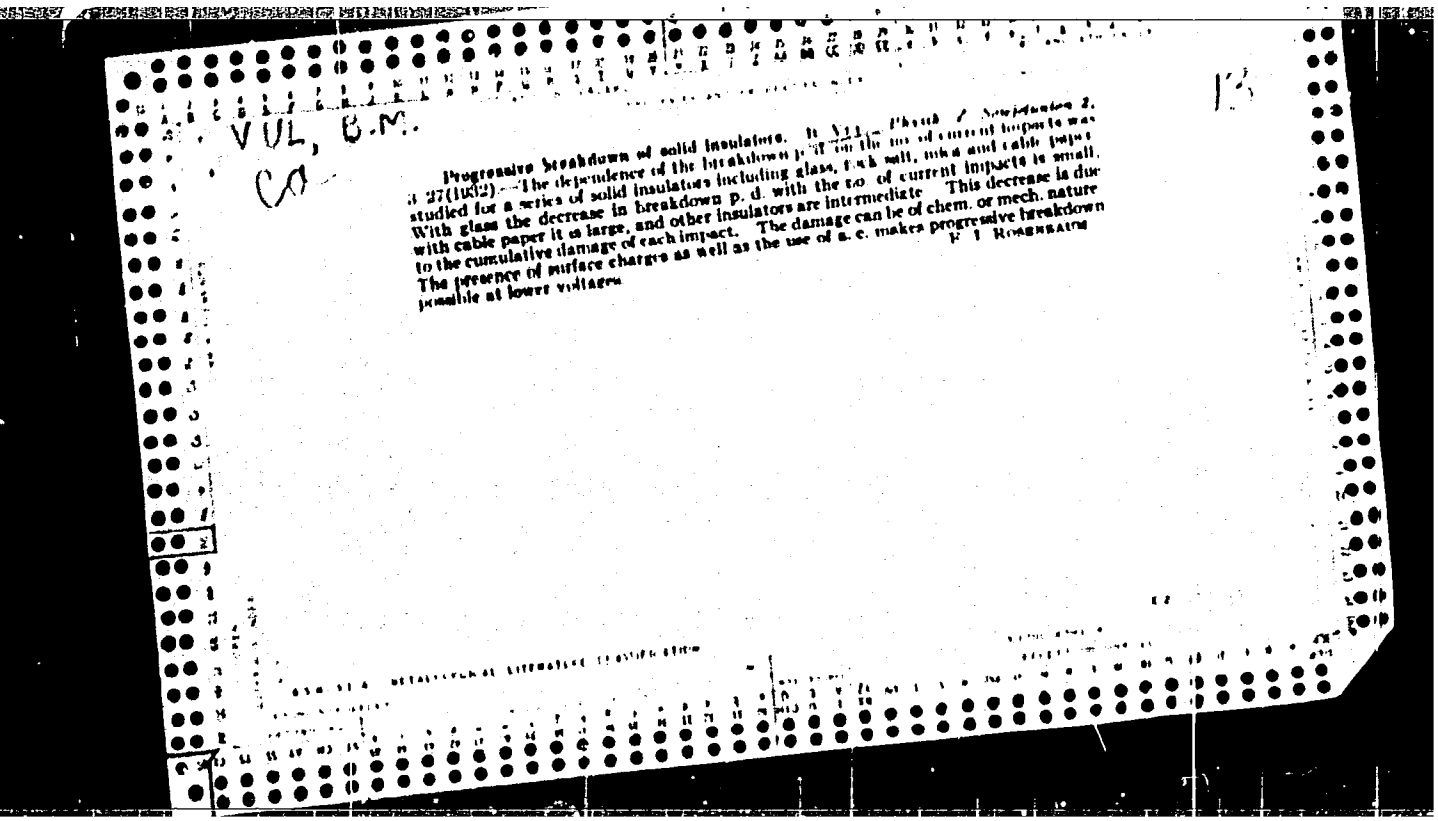


Fig. 1. Tunnel diode memory cell and its phase-space diagram.

Y - Word line, X - bit line.

Card 1/2 UDC: 621.374.32:621.382.233

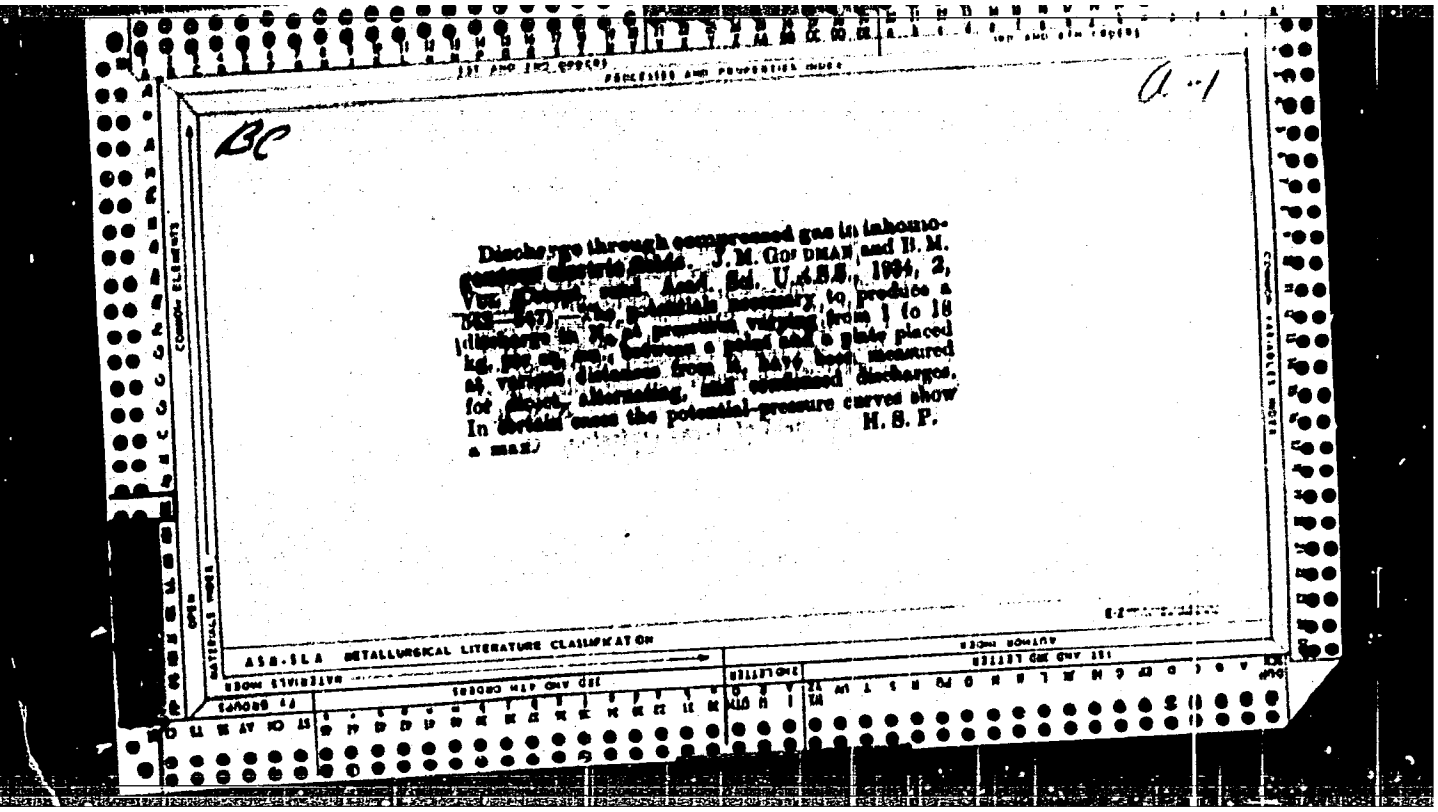


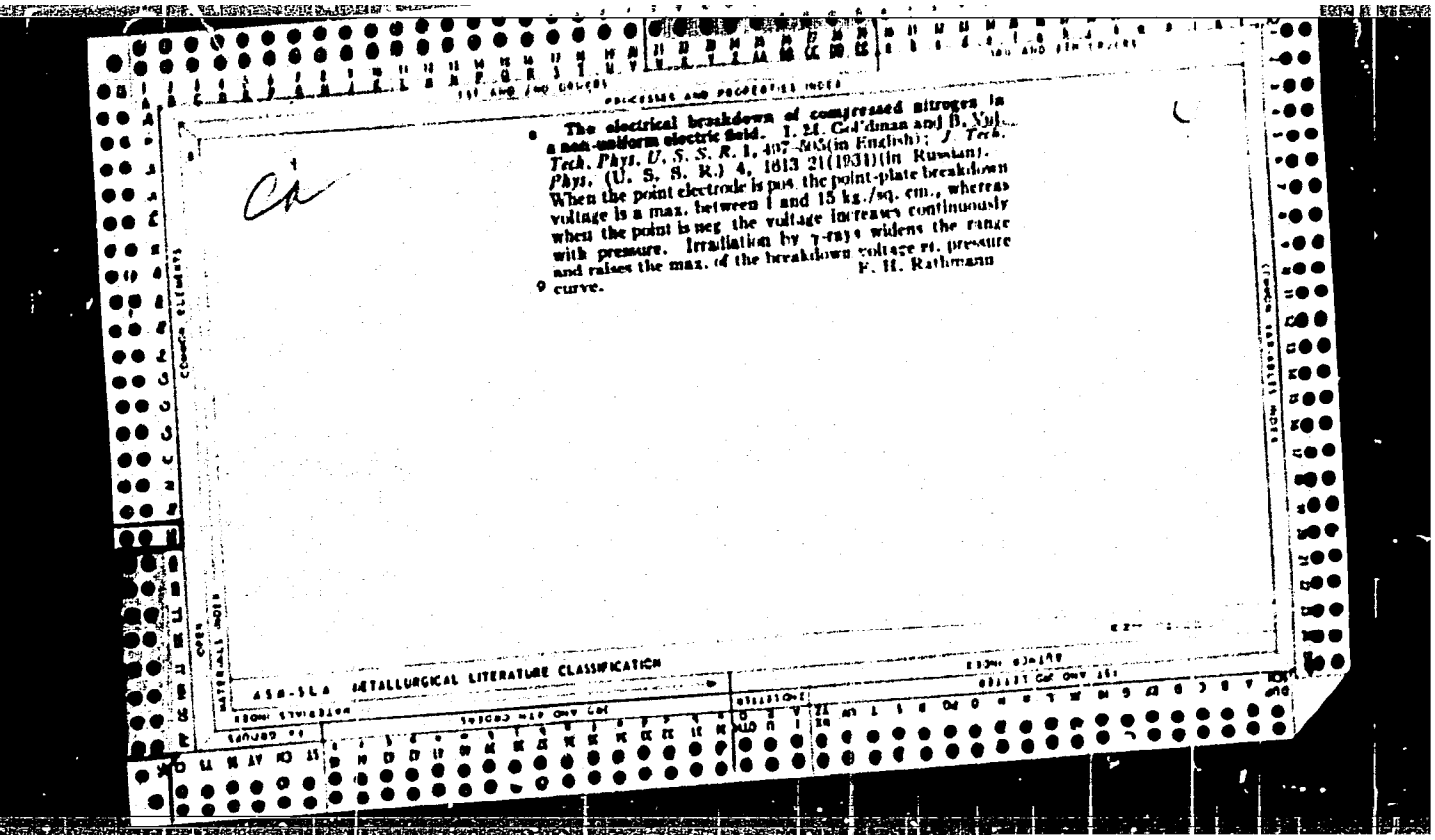
VUL, B.M.

CO

Progressive breakdown of solid insulators. [illegible] Physik. Z. Sowjetunion 2, 27(1932).—The dependence of the breakdown p. d. on the no. of current impacts was studied for a series of solid insulators including glass, rock salt, mica and cable paper. With glass the decrease in breakdown p. d. with the no. of current impacts is small, with cable paper it is large, and other insulators are intermediate. This decrease is due to the cumulative damage of each impact. The damage can be of chem. or mech. nature. The presence of surface charges as well as the use of a. c. makes progressive breakdown possible at lower voltages.

F. I. Rosenblatt

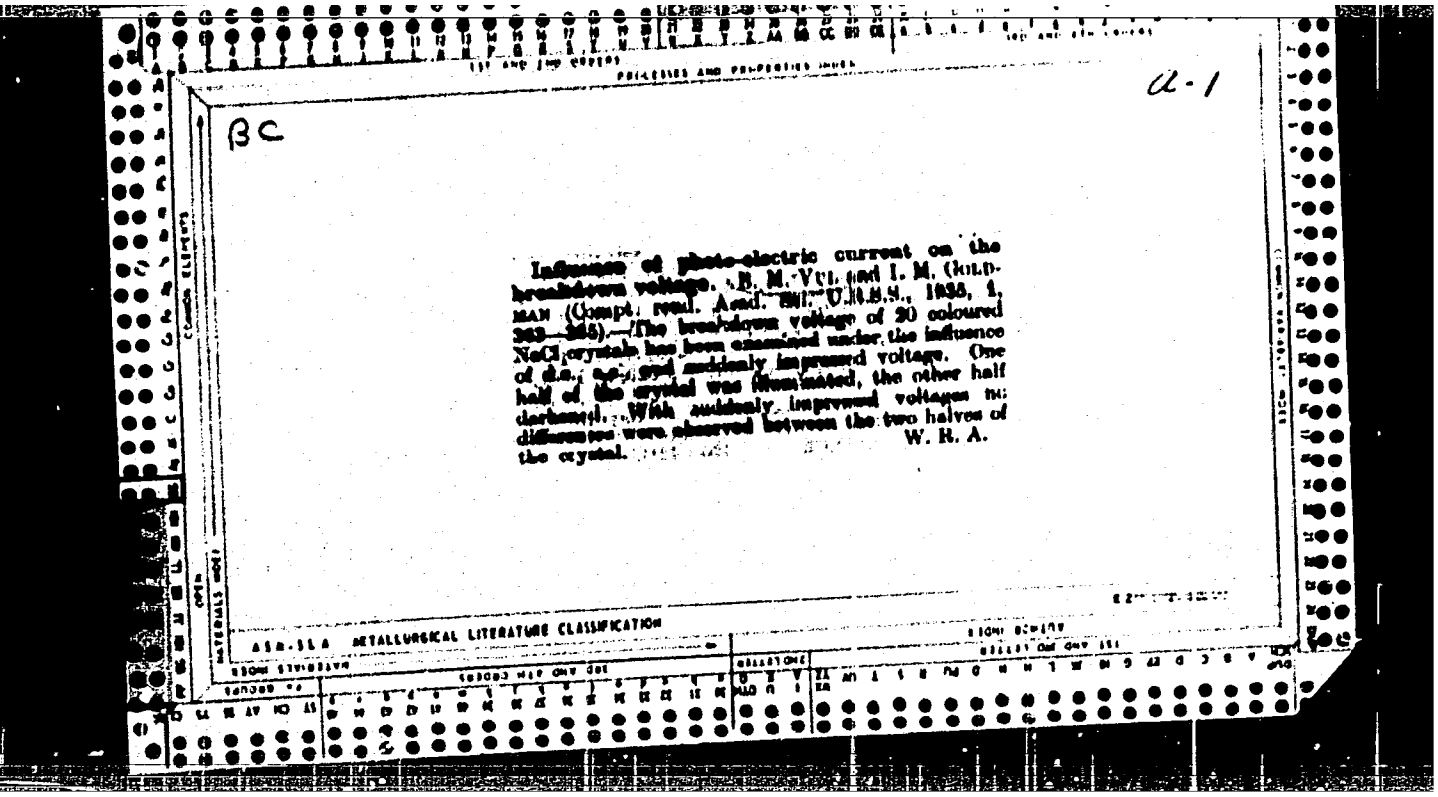




PROCESSES AND PROCEDURES INDEX

The electrical breakdown of compressed nitrogen in a non-uniform electric field. I. M. Gol'dman and D. Vul. *Tech. Phys. U. S. S. R.* **1**, 407–435(in English); *J. Tech. Phys.* (U. S. S. R.) **4**, 1813–21(1934)(in Russian). When the point electrode is pos. the point-plate breakdown voltage is a max. between 1 and 15 kg./sq. cm., whereas when the point is neg. the voltage increases continuously with pressure. Irradiation by γ-rays widens the range and raises the max. of the breakdown voltage vs. pressure curve. F. H. Rathmann

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

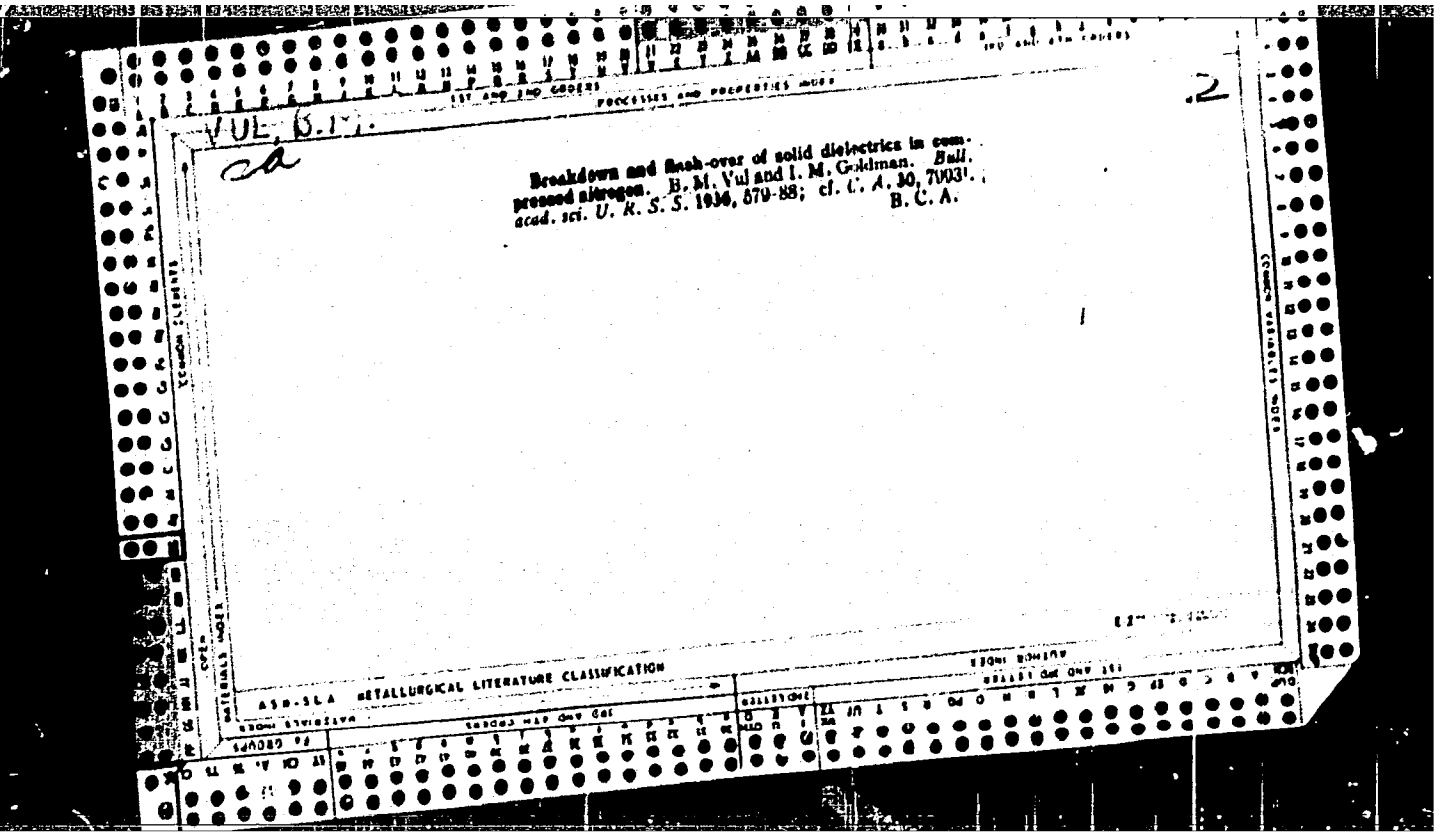


BC

a-1

Influence of photo-electric current on the breakdown voltage. B. M. Vul and I. M. Goldman (Compt. rend. Acad. Sci. U.R.S.S., 1938, 1, 393—395).—The breakdown voltage of 20 coloured NaCl crystals has been examined under the influence of d.c., a.c., and suddenly impressed voltage. One half of the crystal was illuminated, the other half darkened. With suddenly impressed voltages no differences were observed between the two halves of the crystal. W. R. A.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION



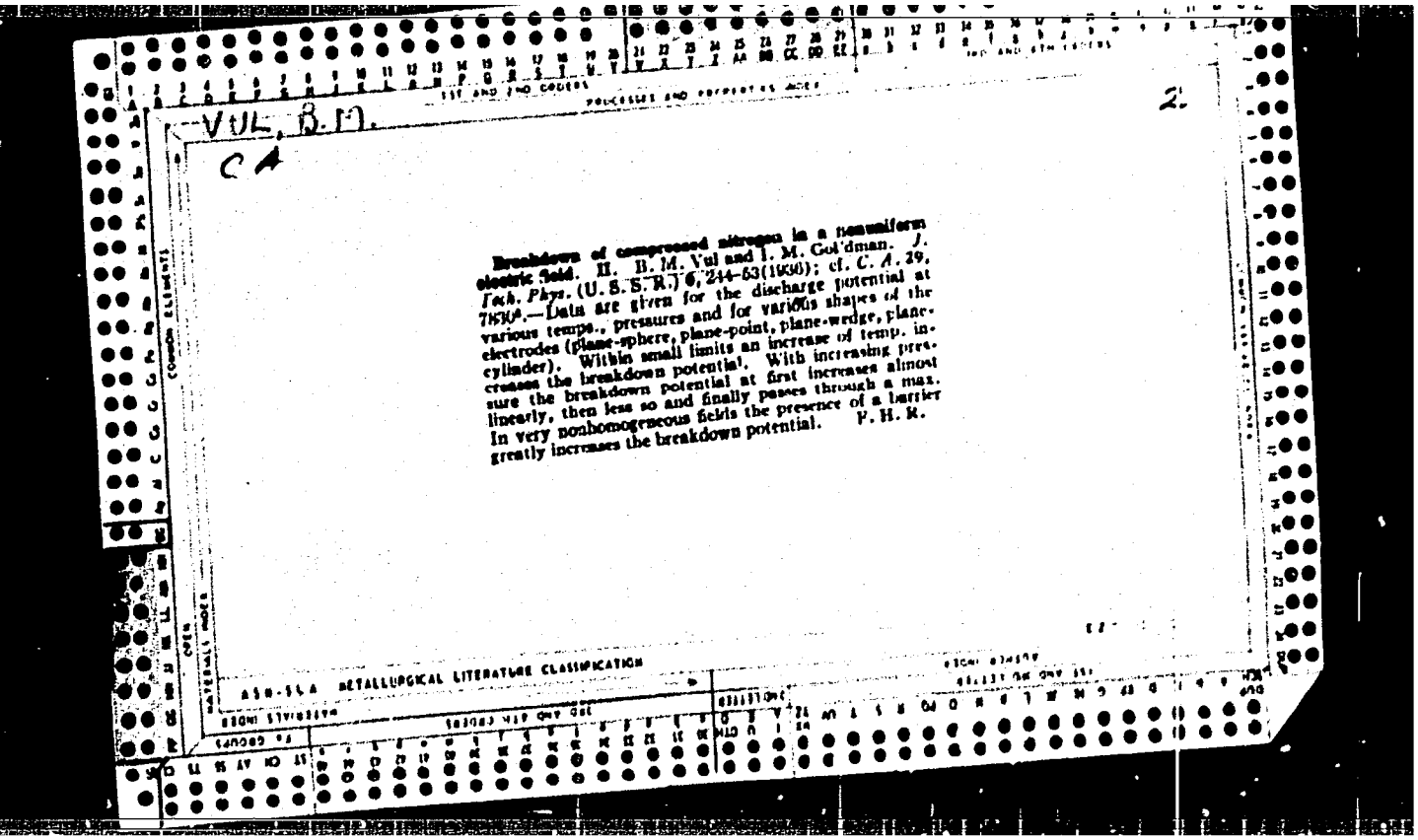
VUL, B.I.

2

Breakdown and flash-over of solid dielectrics in compressed nitrogen. B. M. Vul and I. M. Goldman. *Bull. acad. sci. U. R. S. S.* 1936, 879-88; cf. *C. A.* 30, 7003[1]. B. C. A.

ASD-SLA METALLURGICAL LITERATURE CLASSIFICATION

APPROVED FOR RELEASE: 09/01/2001 CIA-RDP86-00513R001961310002-8"



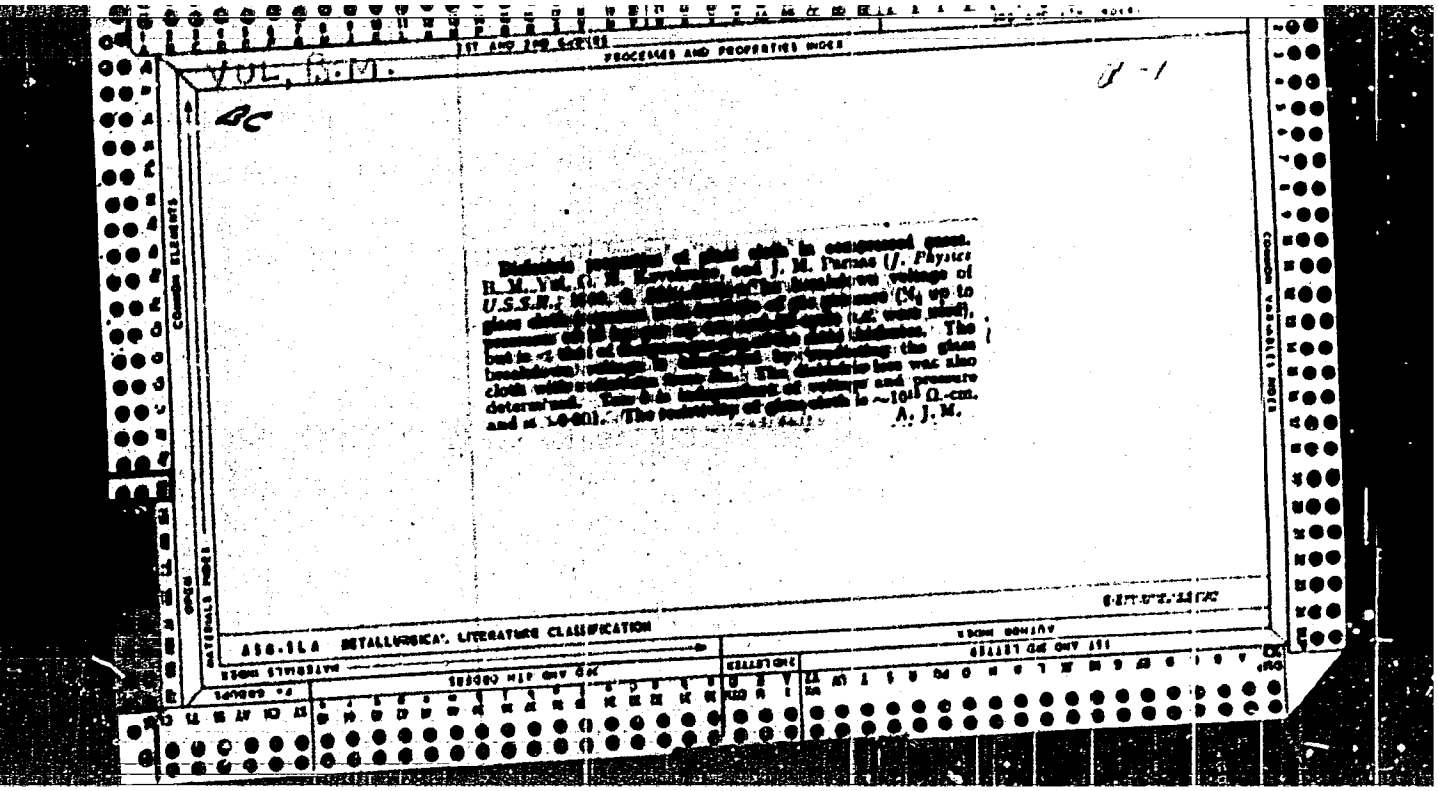
VUL, B. M.

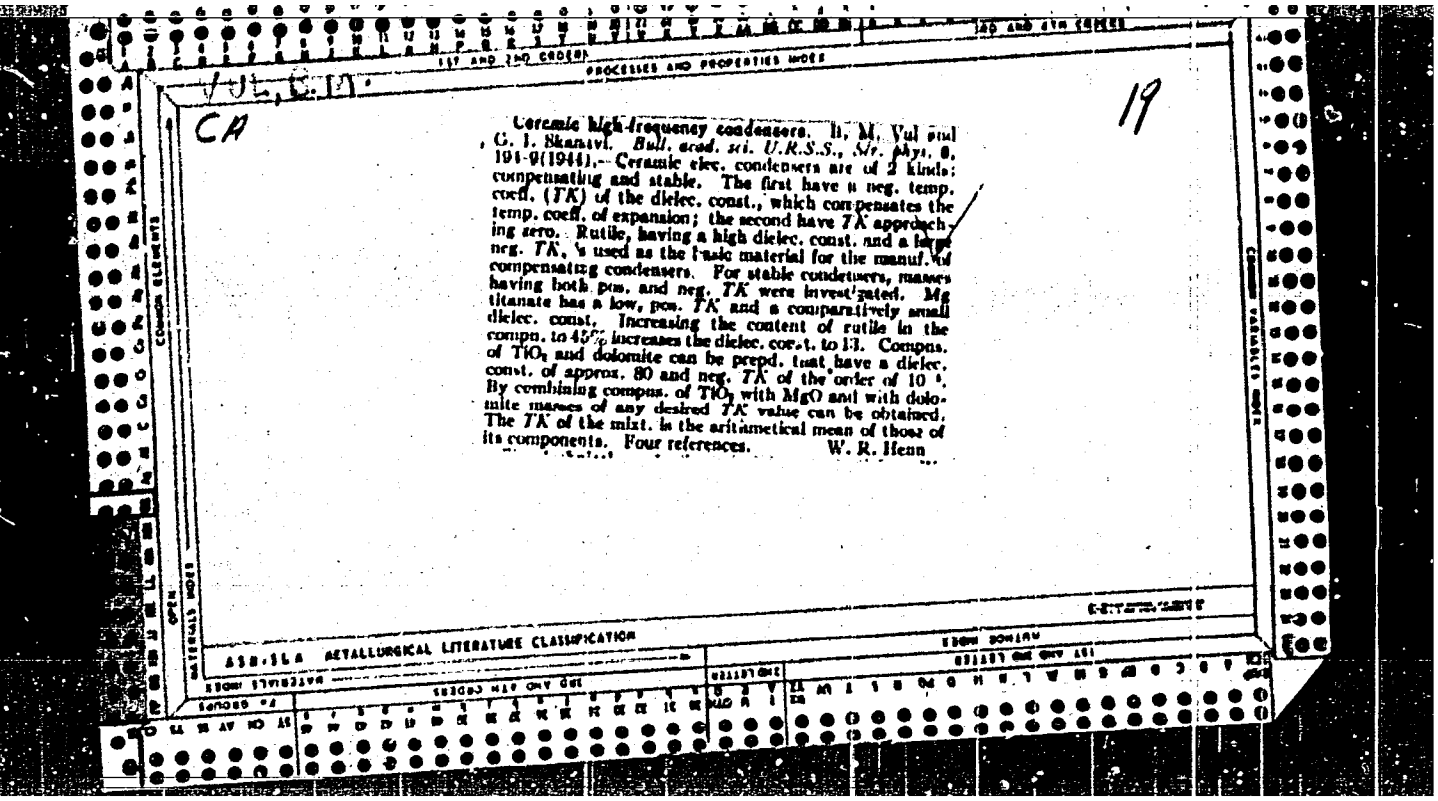
CA

2.

Breakdown of compressed nitrogen in a nonuniform electric field. II. B. M. Vul and I. M. Gol'dman. *J. Tech. Phys.* (U. S. S. R.) 6, 244–53 (1936); cf. *C. A.* 29, 7853⁶.—Data are given for the discharge potential at various temps., pressures and for various shapes of the electrodes (plane-sphere, plane-point, plane-wedge, plane-cylinder). Within small limits an increase of temp. increases the breakdown potential. With increasing pressure the breakdown potential at first increases almost linearly, then less so and finally passes through a max. In very nonhomogeneous fields the presence of a barrier greatly increases the breakdown potential. P. H. R.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION





CA

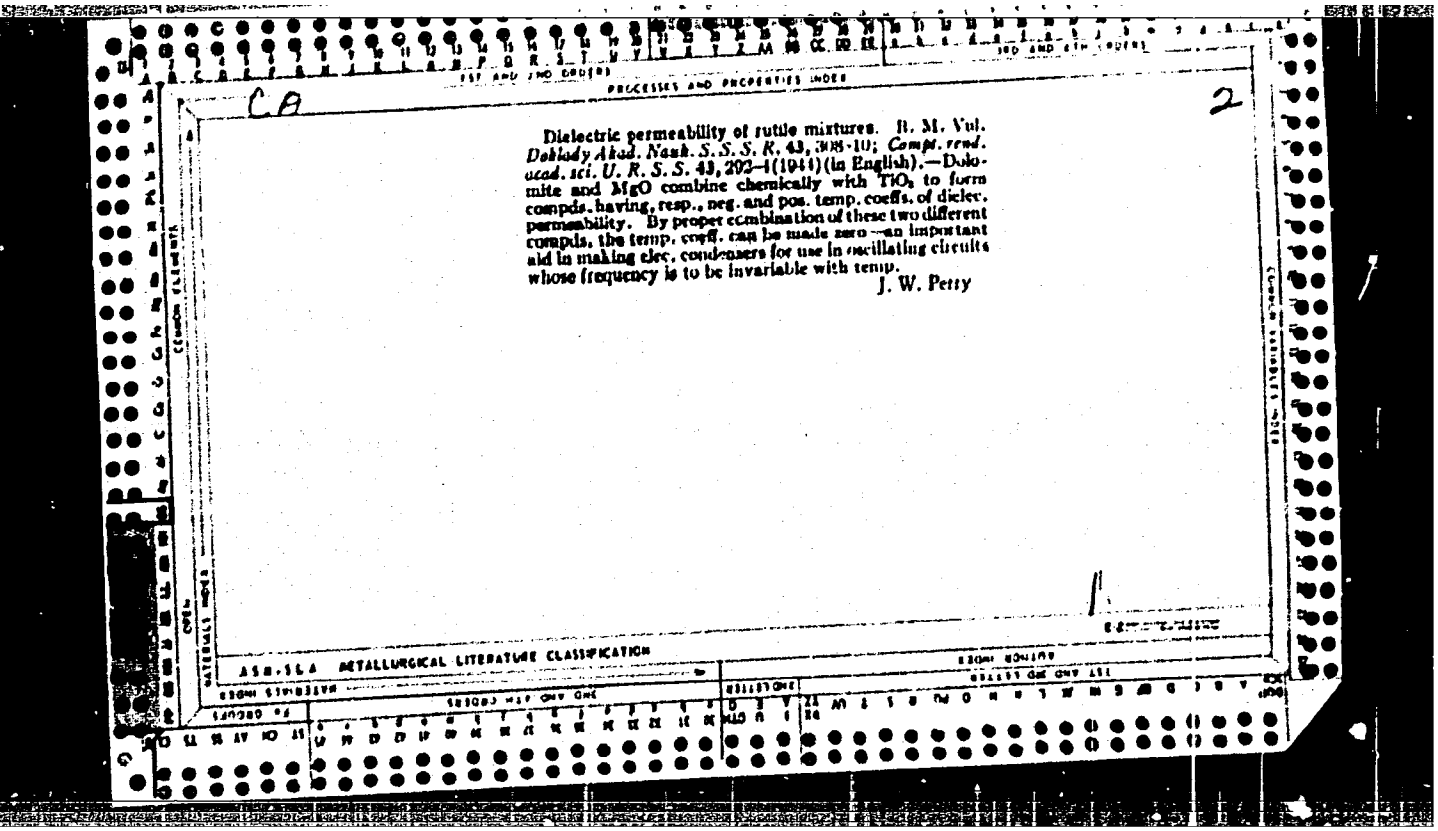
19

Ceramic high-frequency condensers. II. M. Vul and G. I. Skanavi. *Bull. acad. sci. U.R.S.S., Sér. phys.* 8, 191-9(1944).—Ceramic elec. condensers are of 2 kinds: compensating and stable. The first have a neg. temp. coeff. (*TK*) of the dielec. const., which compensates the temp. coeff. of expansion; the second have *TK* approaching zero. Rutile, having a high dielec. const. and a large neg. *TK*, is used as the basic material for the manuf. of compensating condensers. For stable condensers, masses having both pos. and neg. *TK* were investigated. Mg titanate has a low, pos. *TK* and a comparatively small dielec. const. Increasing the content of rutile in the compn. to 45% increases the dielec. const. to 13. Compns. of TiO_2 and dolomite can be prepd. that have a dielec. const. of approx. 80 and neg. *TK* of the order of 10^{-4}. By combining compns. of TiO_2 with MgO and with dolomite masses of any desired *TK* value can be obtained. The *TK* of the mixt. is the arithmetical mean of those of its components. Four references. W. R. Henn

VUL, B. M.

"Dielectric Permeability of Titanium Metals of Group II," a report submitted at General Assemblies of OFMN in 1944.

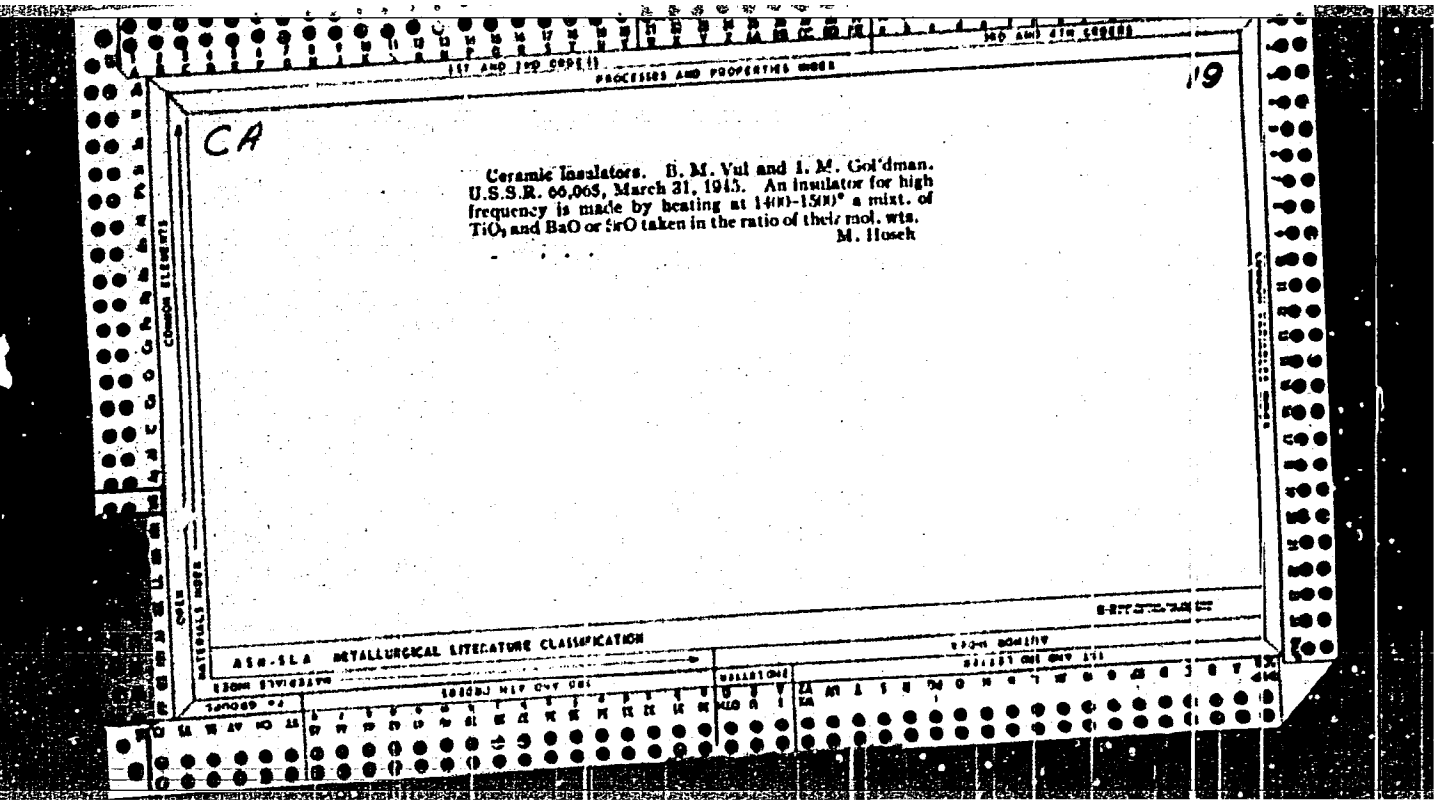
IAN-Ser Fiz., Vol 9, No 3, 1945



CA 2

Dielectric permeability of rutile mixtures. B. M. Vul. *Doklady Akad. Nauk. S. S. S. R.* 43, 308-10; *Compt. rend. acad. sci. U. R. S. S.* 43, 202-4(1944)(in English).—Dolomite and MgO combine chemically with TiO_2 to form compds. having, resp., neg. and pos. temp. coeffs. of dielec. permeability. By proper combination of these two different compds. the temp. coeff. can be made zero—an important aid in making elec. condensers for use in oscillating circuits whose frequency is to be invariable with temp.

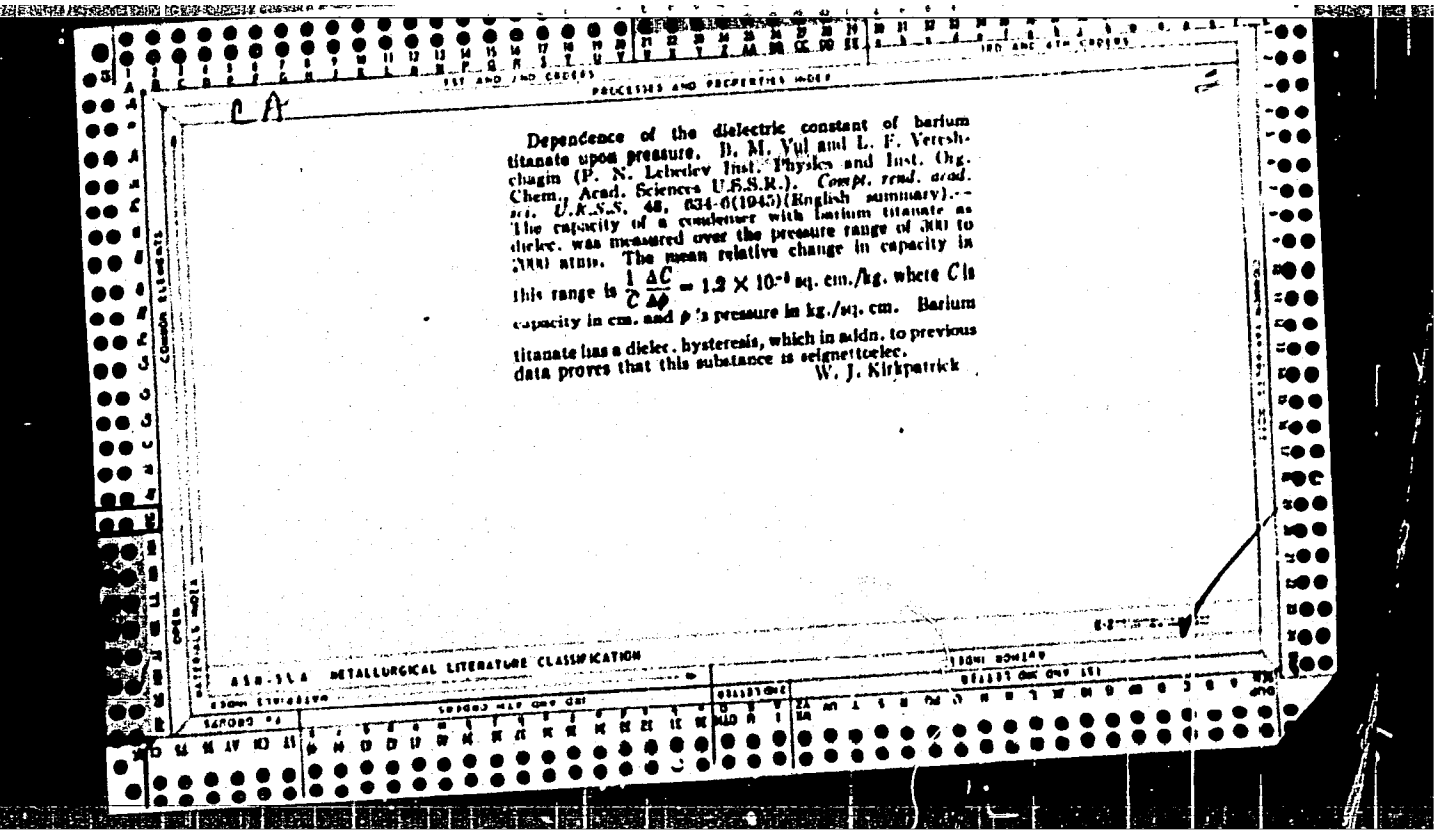
J. W. Perry



VUL, B. M. (Cor Mor.)

"High-Frequency Ceramic Condensers," a report submitted at the General Assemblies of OFMN in 1944

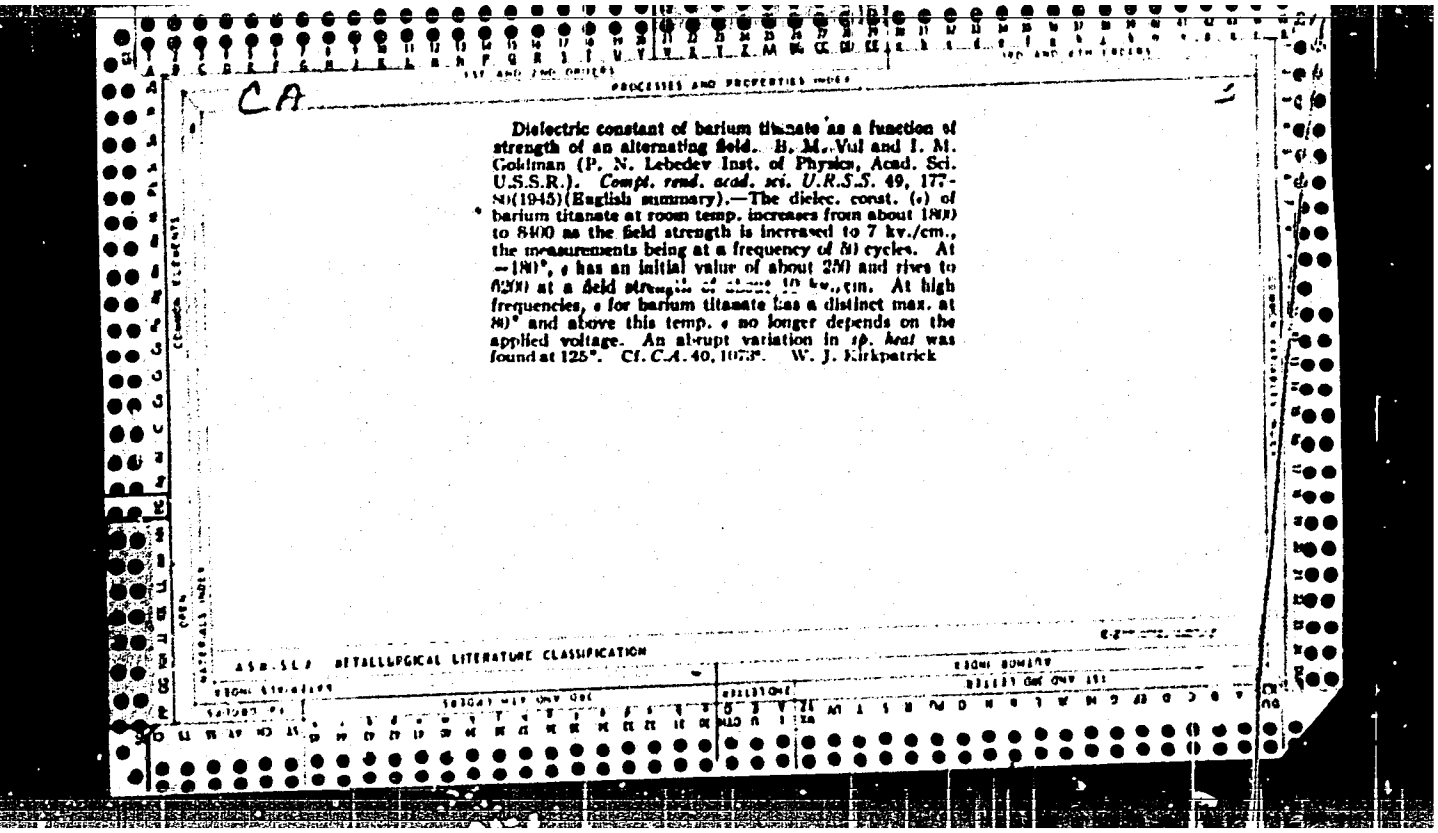
IAN-Ser Fiz, Vol 9, No 3, 1945



CA

Dependence of the dielectric constant of barium titanate upon pressure. D. M. Yul and L. F. Vereshchagin (P. N. Lebedev Inst. Physics and Inst. Org. Chem., Acad. Sciences U.S.S.R.). *Compt. rend. acad. sci. U.R.S.S.* 48, 634-6(1945)(English summary).—The capacity of a condenser with barium titanate as dielec. was measured over the pressure range of 300 to 3000 atmos. The mean relative change in capacity in this range is $\frac{1}{C}\frac{\Delta C}{\Delta p} = 1.2 \times 10^{-4}$ sq. cm./kg. where C is capacity in cm. and p is pressure in kg./sq. cm. Barium titanate has a dielec. hysteresis, which in addn. to previous data proves that this substance is seignettoelec.

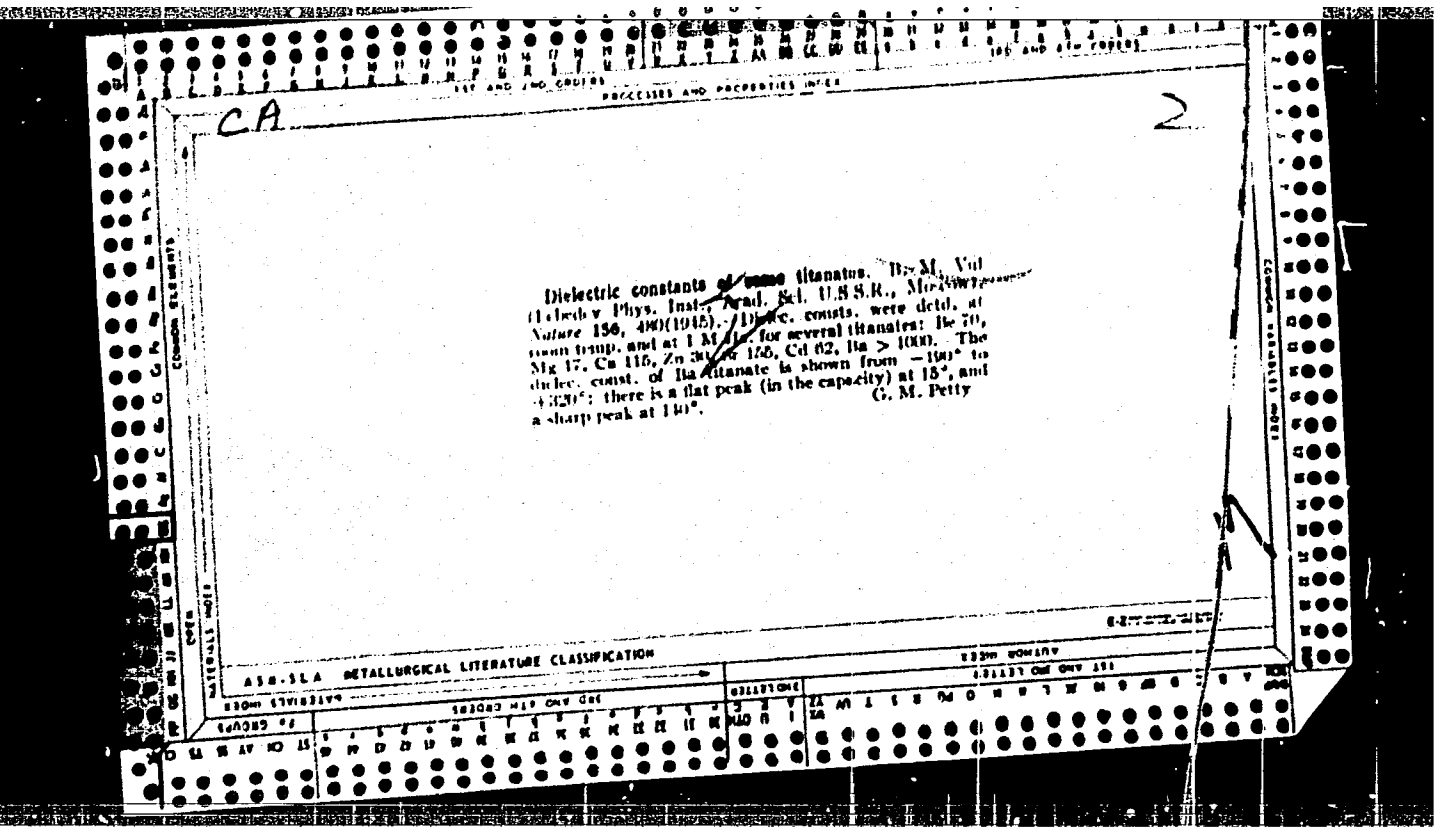
W. J. Kirkpatrick



CA

Dielectric constant of barium titanate as a function of strength of an alternating field. B. M. Vul and I. M. Goldman (P. N. Lebedev Inst. of Physics, Acad. Sci. U.S.S.R.). *Compt. rend. acad. sci. U.R.S.S.* 49, 177-80(1945)(English summary).—The dielec. const. (ε) of barium titanate at room temp. increases from about 1800 to 8400 as the field strength is increased to 7 kv./cm., the measurements being at a frequency of 50 cycles. At −180°, ε has an initial value of about 250 and rises to 6200 at a field strength of about 10 kv./cm. At high frequencies, ε for barium titanate has a distinct max. at 80° and above this temp. ε no longer depends on the applied voltage. An abrupt variation in *sp. heat* was found at 125°. Cf. *C.A.* 40, 1073⁸. W. J. Kirkpatrick

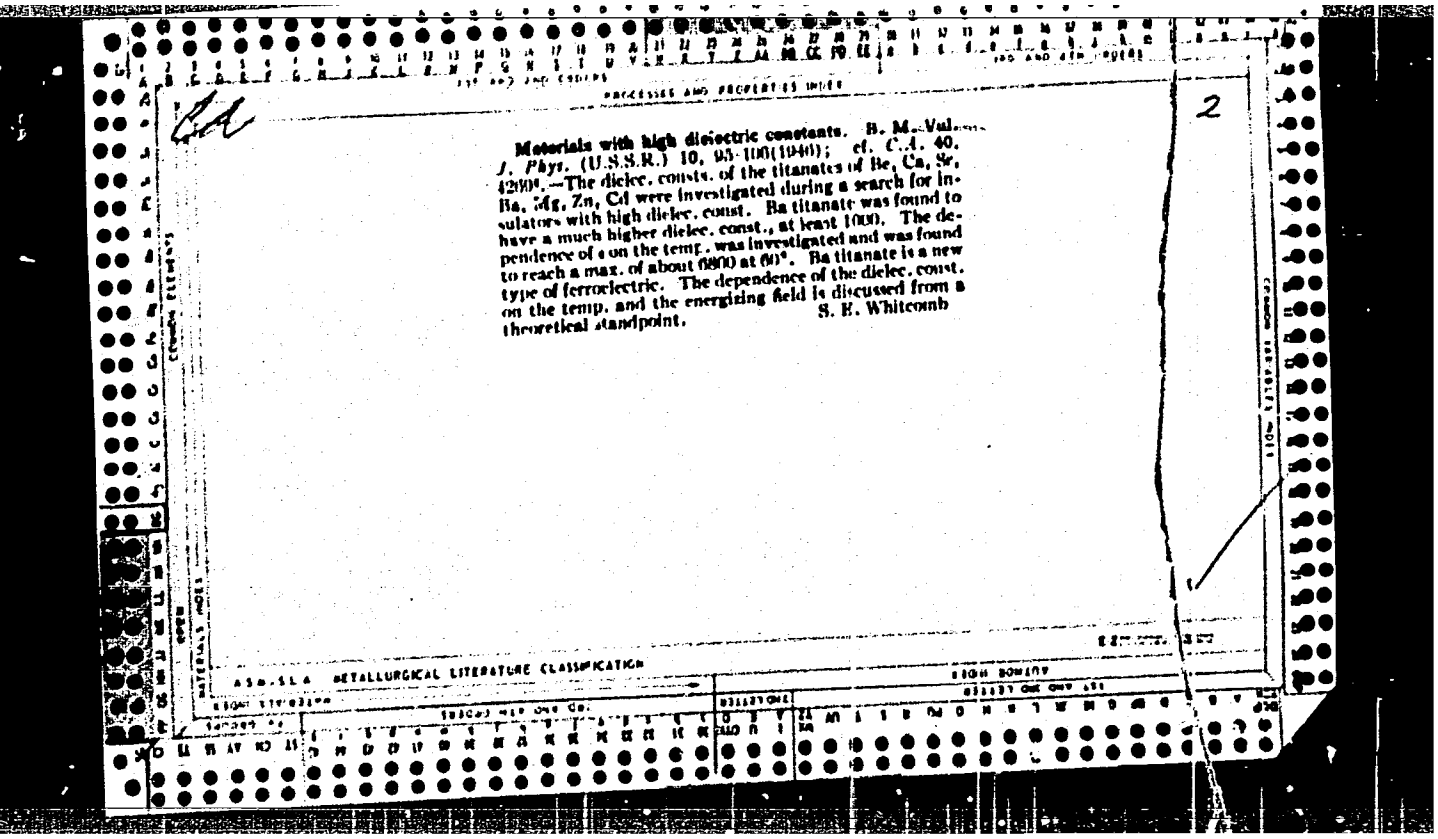
A.S.M.-S.L.A. METALLURGICAL LITERATURE CLASSIFICATION



CA 2

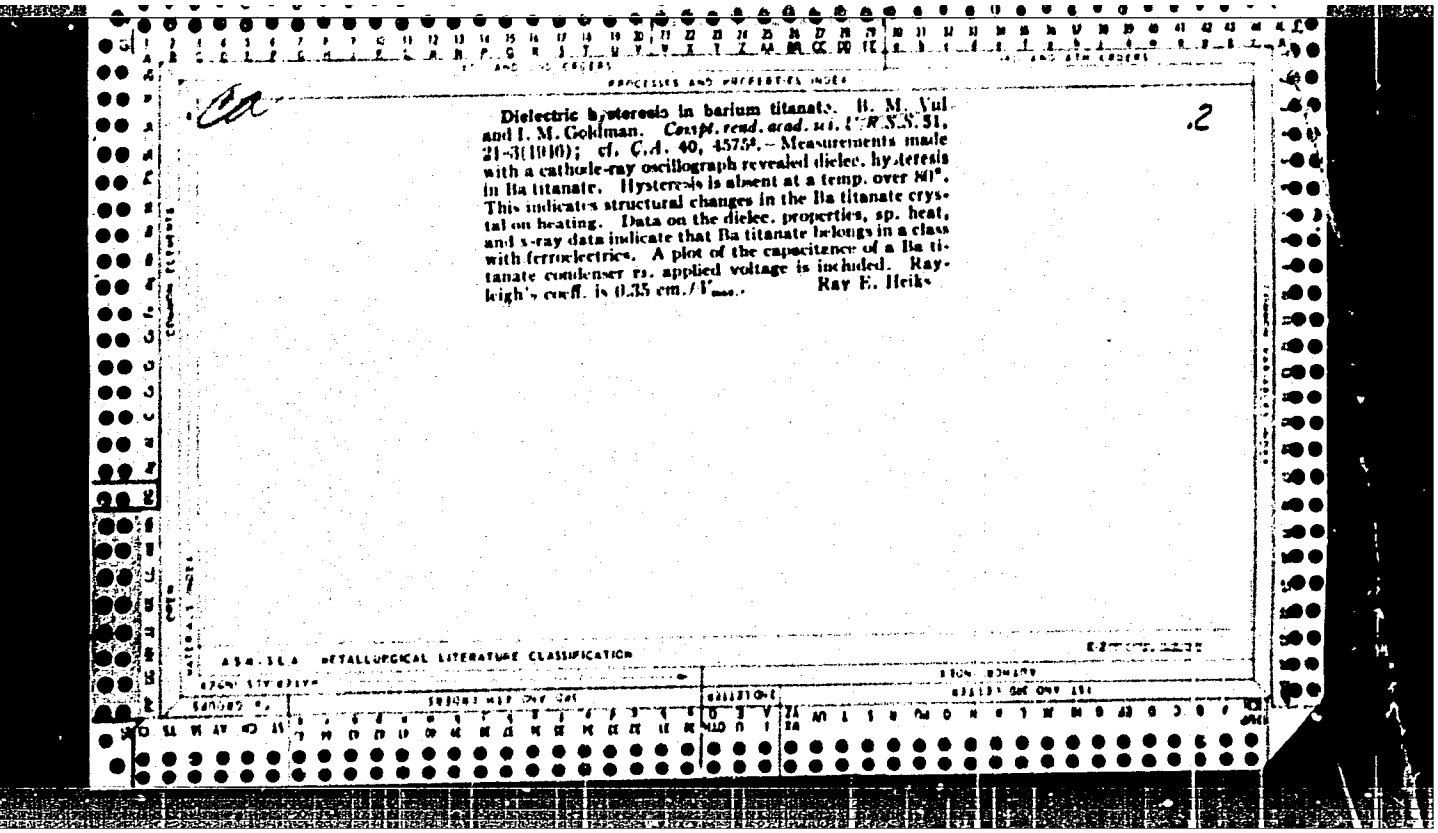
Dielectric constants of some titanates. By M. Vul (Lebedev Phys. Inst., Acad. Sci. U.S.S.R., Moscow). *Nature* 156, 490(1945).—Dielec. consts. were detd. at room temp. and at 1 Mc./sec. for several titanates: Be 70, Mg 17, Ca 115, Zn 30, Sr 175, Cd 62, Ba > 1000. The dielec. const. of Ba titanate is shown from −100° to +320°; there is a flat peak (in the capacity) at 15°, and a sharp peak at 140°. G. M. Petty

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION



Materials with high dielectric constants. B. M. Vul. *J. Phys.* (U.S.S.R.) 10, 95-100(1946); cf. C.A. 40, 4200.—The dielec. consts. of the titanates of Be, Ca, Sr, Ba, Mg, Zn, Cd were investigated during a search for insulators with high dielec. const. Ba titanate was found to have a much higher dielec. const., at least 1000. The dependence of ϵ on the temp. was investigated and was found to reach a max. of about 6000 at 60°. Ba titanate is a new type of ferroelectric. The dependence of the dielec. const. on the temp. and the energizing field is discussed from a theoretical standpoint. S. E. Whitcomb

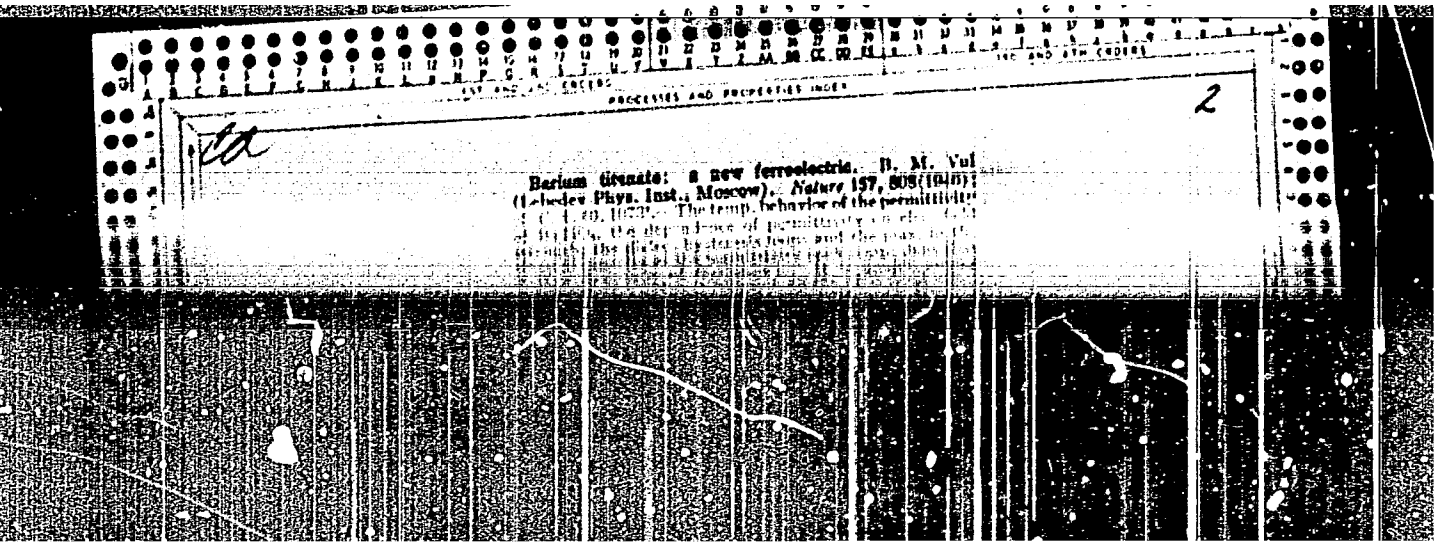
APPROVED FOR RELEASE: 09/01/2001 CIA-RDP86-00513R001961310002-8"

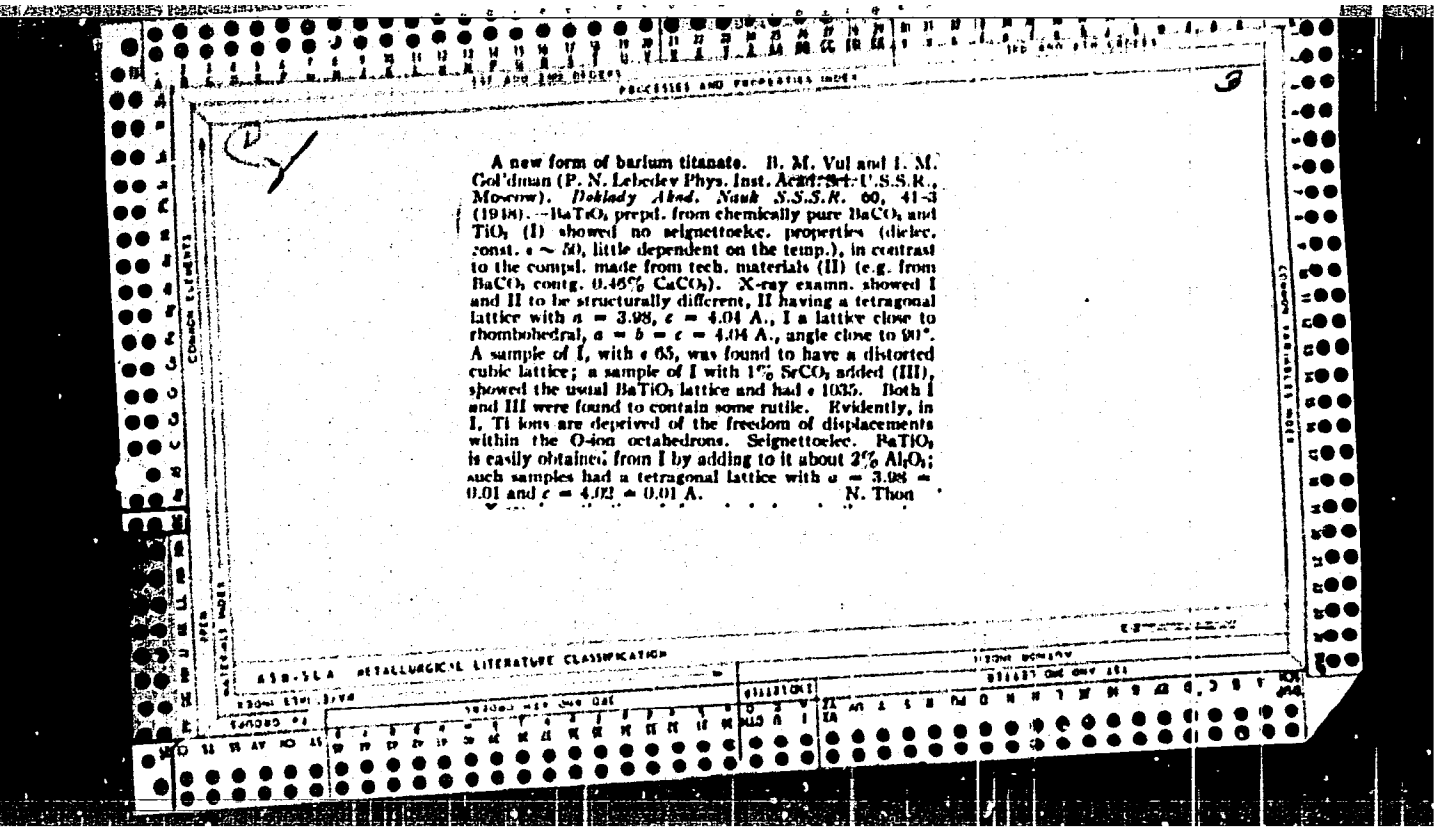


Dielectric hysteresis in barium titanate. H. M. Yul and I. M. Goldman. *Compt. rend. acad. sci. U.R.S.S.* 31, 21-3(1940); cf. *C.A.* 40, 4575⁸.—Measurements made with a cathode-ray oscillograph revealed dielec. hysteresis in Ba titanate. Hysteresis is absent at a temp. over 80°. This indicates structural changes in the Ba titanate crystal on heating. Data on the dielec. properties, sp. heat, and x-ray data indicate that Ba titanate belongs in a class with ferroelectrics. A plot of the capacitance of a Ba titanate condenser vs. applied voltage is included. Ray-leigh's coeff. is 0.35 cm./$V_{max.}$. Ray E. Heiks

.2

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION





A new form of barium titanate. B. M. Vul and I. M. Gol'dman (P. N. Lebedev Phys. Inst. Acad. Sci. U.S.S.R., Moscow). *Doklady Akad. Nauk S.S.S.R.* 60, 41-3 (1948).—$BaTiO_3$ prepn. from chemically pure $BaCO_3$ and TiO_2 (I) showed no seignettoelec. properties (dielec. const. $\epsilon \sim 50$, little dependent on the temp.), in contrast to the compn. made from tech. materials (II) (e.g. from $BaCO_3$ contg. 0.46% $CaCO_3$). X-ray examn. showed I and II to be structurally different, II having a tetragonal lattice with $a = 3.98$, $c = 4.04$ A., I a lattice close to rhombohedral, $a = b = c = 4.04$ A., angle close to 90°. A sample of I, with ϵ 65, was found to have a distorted cubic lattice; a sample of I with 1% $SrCO_3$ added (III), showed the usual $BaTiO_3$ lattice and had ϵ 1035. Both I and III were found to contain some rutile. Evidently, in I, Ti ions are deprived of the freedom of displacements within the O-ion octahedrons. Seignettoelec. $BaTiO_3$ is easily obtained from I by adding to it about 2% Al_2O_3; such samples had a tetragonal lattice with $a = 3.98 \pm 0.01$ and $c = 4.02 \pm 0.01$ A. N. Thon

VUL, B.M.

Present-day state of the physics of dielectrics. Elektrichestvo no.1:3-12 Ja '49. (MLRA 7:10)

1. Fizicheskiy institut im. Lebedeva Akademii nauk SSSR. 2. Chlen-korrespondent Akademii nauk SSSR.
(Dielectrics)

VUL, B. M.

USSR/Physics - Titanates
Dielectrics

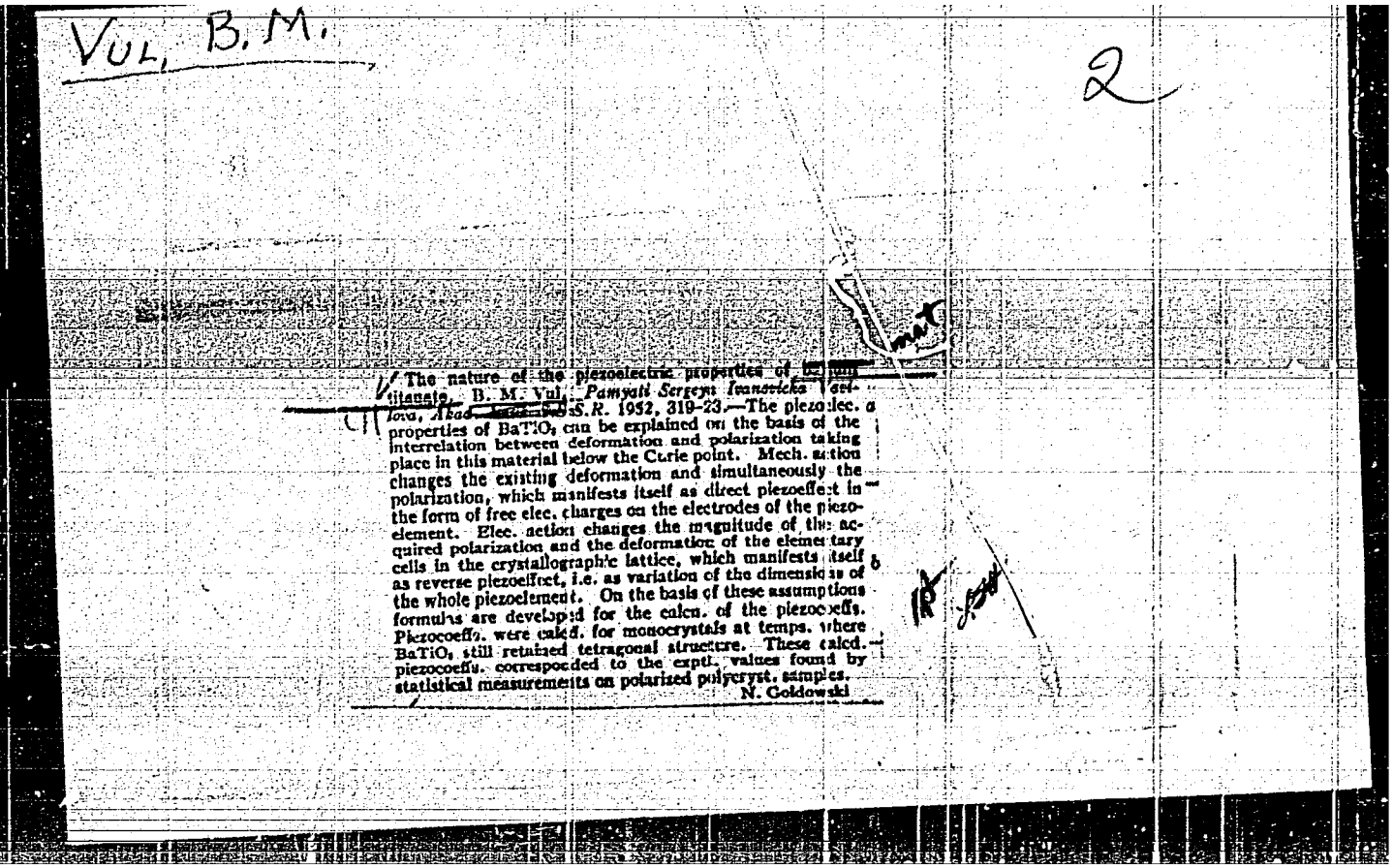
May 50

"Electrical Strength (KV/CM) of Titanates of Metals in the Second Group of the Periodic Table," B. M. Vul, I. M. Gol'dman, R. Ya. Razbash, Phys Inst imeni Lebedev, Acad Sci USSR, 6 pp

"Zhur Eksper i Teoret Fiz" Vol XX, No 5

Establishes that electrical strengths 175 to 65 kv/cm, respectively, of titanates of Be, Ma, Ca, Zn, Sr, Cd, Ba are relatively small and depend only slightly on composition. Measurements on BaTiO, lowest in electrical strength, show that significant variations in dielectric permeability do not influence its electrical strength. Submitted 31 Dec 49.

160T98



VUL, B. M.

2

The nature of the piezoelectric properties of [illegible] titanate. B. M. Vul. *Pamyati Sergeya Ivanovicha Vavilova, Akad. Sbornik, U.S.S.R.* 1952, 319–23.—The piezoelec. properties of $BaTiO_3$ can be explained on the basis of the interrelation between deformation and polarization taking place in this material below the Curie point. Mech. action changes the existing deformation and simultaneously the polarization, which manifests itself as direct piezoeffect in the form of free elec. charges on the electrodes of the piezoelement. Elec. action changes the magnitude of the acquired polarization and the deformation of the elementary cells in the crystallographic lattice, which manifests itself as reverse piezoeffect, i.e. as variation of the dimensions of the whole piezoelement. On the basis of these assumptions formulas are developed for the calcn. of the piezocoeffs. Piezocoeffs. were calcd. for monocrystals at temps. where $BaTiO_3$ still retained tetragonal structure. These calcd. piezocoeffs. corresponded to the exptl. values found by statistical measurements on polarized polycryst. samples.

N. Goldowski

VUL', V. M.

USSR/Electronics - Piezoelectricity

Apr 53

"Application of Piezoelectric Devices," A. Plonskiy

"Radio, No 4, pp 23-25

General account of the use of piezoelectric devices as ultrasonic radiators, as transducers for the measurement of pressure, acceleration, and vibrations, as the sensitive element in quartz clocks, etc. A. V. Shubnikov, V. M. Vul', and V. P. Konstantinova are credited with developing a theory of piezoelectricity.

PA 255T91

VUL, B. M.

USSR/Physics

Card 1/1

Author : Vul, B. M., Memb. Corresp. of AN SSSR

Title : Capacity of transitory layers in semi-conductors

Periodical : Dokl. AN SSSR, 96, Ed. 2., 257 - 259, May 1954

Abstract : A transitory layer between parts of a semi-conductor having different degree of conductivity expands to the boundaries of space charges where the intensity of the electrical field can be considered zero. The boundaries of space charges may very under the effect of the intensity applied from without. The differential capacity can easily be measured thus enabling to determine the thickness of the transitory layer in relation to the constant intensity applied from without. Three references; 1 USSR 1953.

Institution : The P. N. Lebedev Physics Institute at the Acad. of Sc. USSR.

Submitted : March 6, 1954

Vul, B.M.

AID P - 3031

Subject : USSR/Electricity

Card 1/1 Pub. 27 - 18/33

Author : Vul, B. M., Corr. Memb., Academy of Sciences, USSR

Title : Physical grounds for the technical utilization of semiconductors

Periodical : Elektrichestvo, 7, 102-107, Jl 1955

Abstract : The author briefly reports on the principles of operation of semiconductor rectifiers (diodes), amplifiers (triodes), and also of thermo- and photo-elements. He enumerates their advantages and possible applications. Two diagrams, 8 references (1953-1955) (6 Soviet).

Institution : None

Submitted : My 18, 1955

VuL, B.M.

FD-2397

USSR/Physics - Semiconductors

Card 1/1 Pub. 153-1/21

Author : Vul, B. M.

Title : Dielectric properties of the transitional layer in semiconductors

Periodical : Zhur. tekh. fiz. 25, 3-10, Jan 1955

Abstract : Transitional layers are created in semiconductors in connection with sharp changes in the concentration of the admixtures (impurities) serving as sources of electrons or as their sinks (i.e. as donors or acceptors). The role of transitional layers between two semiconductors with different types of conductivities was theoretically treated for the first time by B. I. Davydov (ibid. 8, 1938), and experimentally investigated by A. V. Ioffe (ibid. 18, 1948); a detailed survey of the modern theory of solid rectifiers and contact semiconductors was given by A. I. Gubanov (ibid. 23, 1953). In most works the principal task has been the clarification of the process of rectification and therefore the effects of the joint action in the transitional layer of diffusion and electrical conductivity have been considered. In the present work the author considers the capacity, resistance, and dielectric losses of the transitional layer under the condition where the contact difference of potentials is much larger than kT/q (q: electron charge). 9 ref.

Institution: --

Submitted : April 30, 1954

PHASE 1 BOOK EXPLOITATION 947

Vul, B.M., Corresponding Member, USSR Academy of Sciences

Segnetoelektrichestvo (Seignettoelectricity) Moscow, Izd-vo AN SSSR, 1956. 27 p. (Series: Akademiya nauk SSSR. Nauchno-populyarnaya seriya) 7,000 copies printed.

Resp. Ed.: Vonsovskiy, S.V., Corresponding Member, USSR Academy of Sciences; Ed. of Publishing House: Dreyer, O.K.; Tech. Ed.: Makuni, Ye. V.

PURPOSE: The book may be useful to persons working with ferroelectric materials.

COVERAGE: A discussion of ferroelectric (seignettoelectric) materials is presented. Attention is given to a description of Carium titanate and the application of ferroelectric materials in the construction of electrical devices. No personalities are mentioned. There are 14 references, of which 10 are Soviet and 4 English.

Card 1/3

Seignettoelectricity

TABLE OF CONTENTS:

Card 2/ 3

Bibliography

AVAILABLE: Library of Congress (TK 453 .v8)

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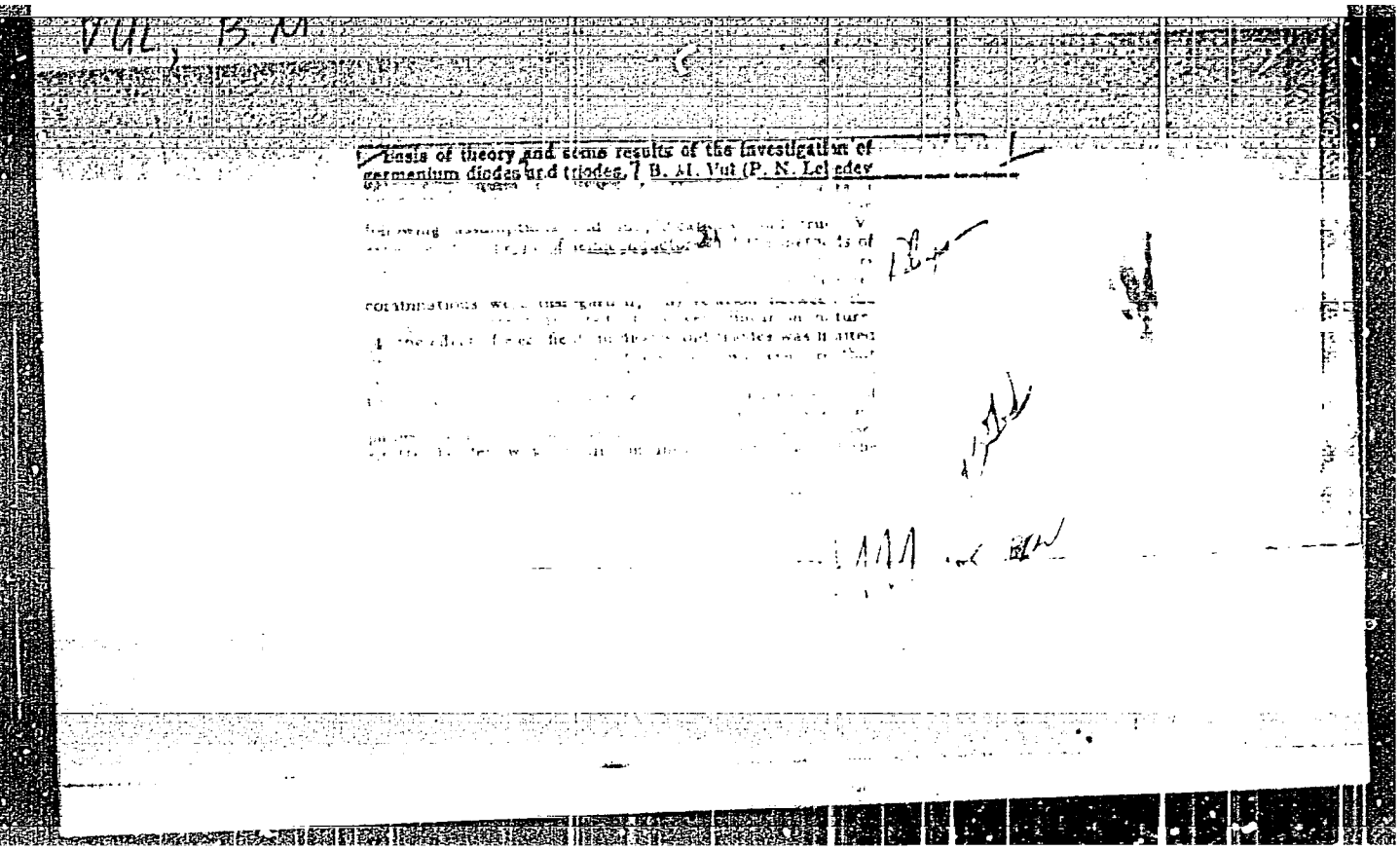
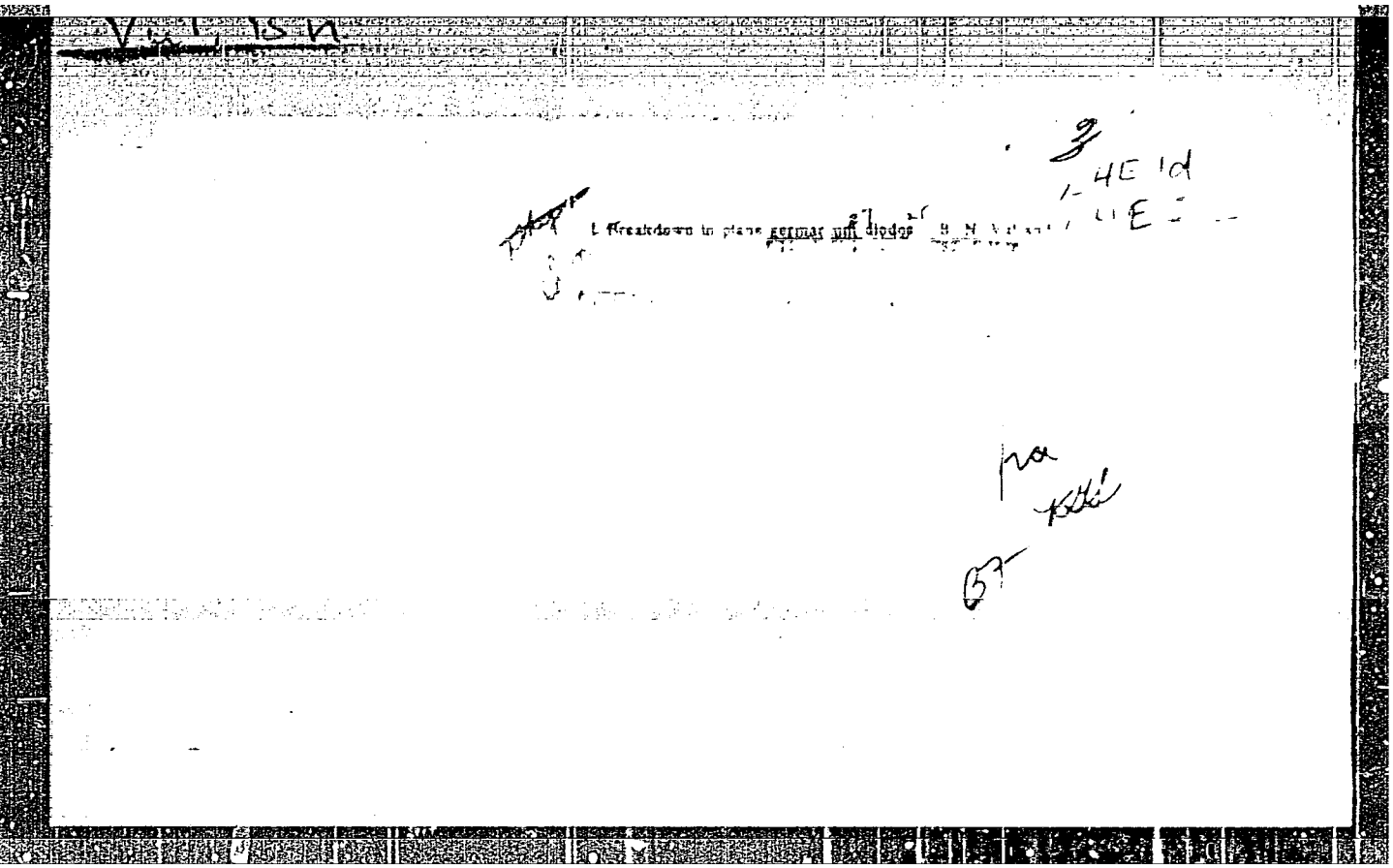
12-10-58

Card 3/3



Basis of theory and some results of the investigation of germanium diodes and triodes. / B. M. Vul (P. N. Lebedev



VUL, B. M.

Category : CHINA/Electricity - Semiconductors G-3

Abs Jour : Ref Zhur - Fizika, No 1, 1957 No 1554

Author : Vul, B.M., Khuan Kun', Van, Shou-u
Title : Physical Fundamentals and Technical Use of Semiconductors

Orig Pub : Kesye tunbao, 1956, No 6, 20-28

Abstract : No abstract

Card : 1/1

VUL, B.M.

Crystals with a great future. Tekh.mol. 24 no.5:7-11 My '56. (MLRA 9:8)

1. Chlen-korrespondent Akademii nauk SSSR.
(Semiconductors)

Vul, B.M.

Category : USSR/Electricity - Dielectrics G-2

Abs Jour : Ref Zhur - Fizika, No 2, 1957, No 4147

Author : Bogdanov, S.V., Vul, B.M., Razbash, R.Ya.
Title : Influence of Polarization Conditions on the Piezo Properties of Barium Titanate

Orig Pub : Zh. tekhn. fiziki, 1956, 26, No 5, 958-962

Abstract : The effect of the intensity of the polarizing electric field E and of the temperature T on the piezo-modulus d_{33} of ceramic $BaTiO_3$ was investigated. It is shown, that the polarization of thick specimens can be produced at lower values of E and at higher values of T. The closer the polarization temperature is to the Curie temperature, the less the value of E required for the polarization.

To orient the fundamental part of the domains in the interval of the rapid growth of the spontaneous polarization (6 -- 7° below the Curie point), E must not be less than 5 kv/cm for any values of T of the polarization.

Card : 1/1

CARD 1 / 2 PA - 1678

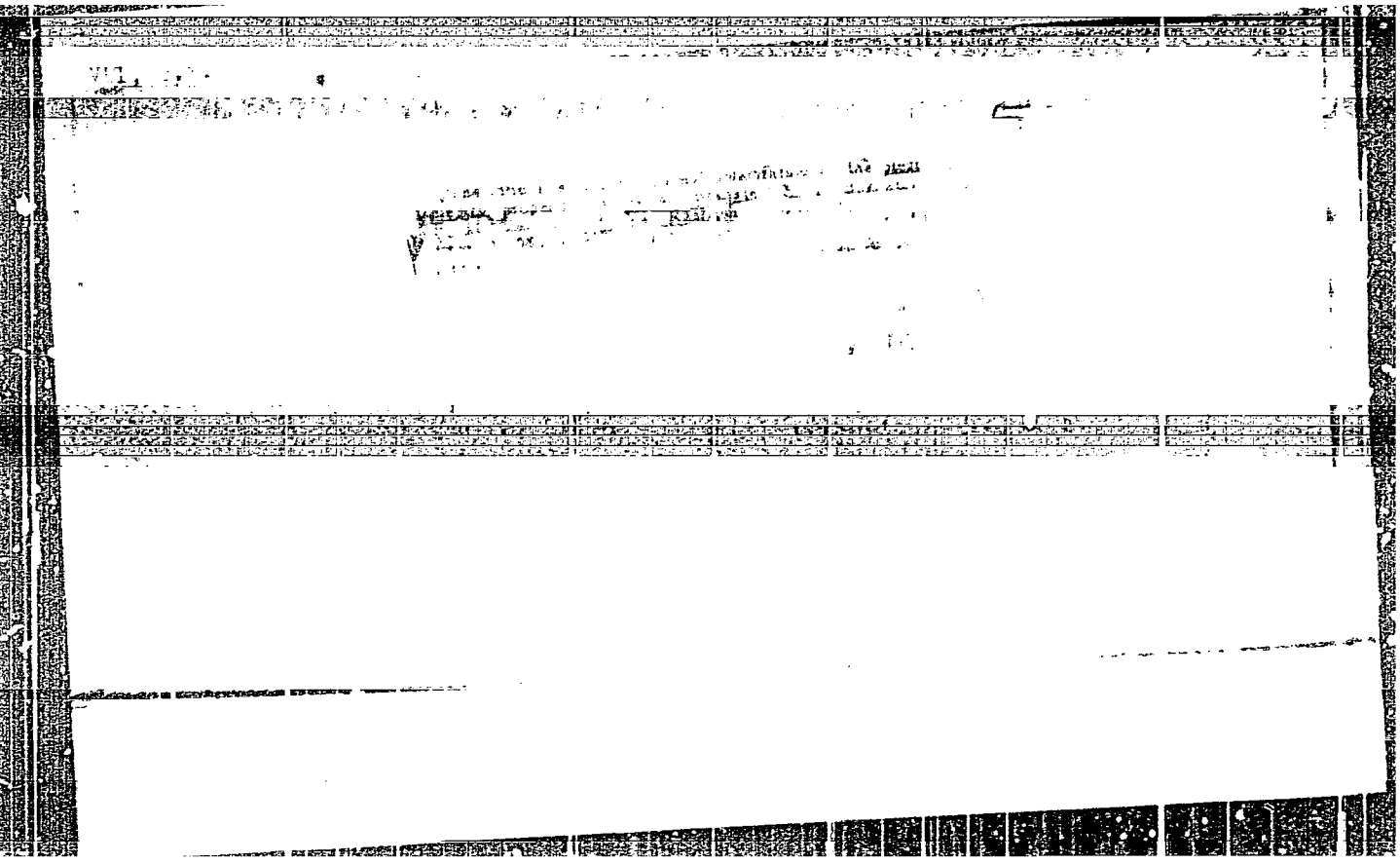
SUBJECT USSR / PHYSICS
AUTHOR VUL,B,M.
TITLE On the Breakdown of Transition Layers in Semiconductors.
PERIODICAL Žurn.techn.fis,26, fasc.11, 2403-2416 (1956)
Issued: 12 / 1956

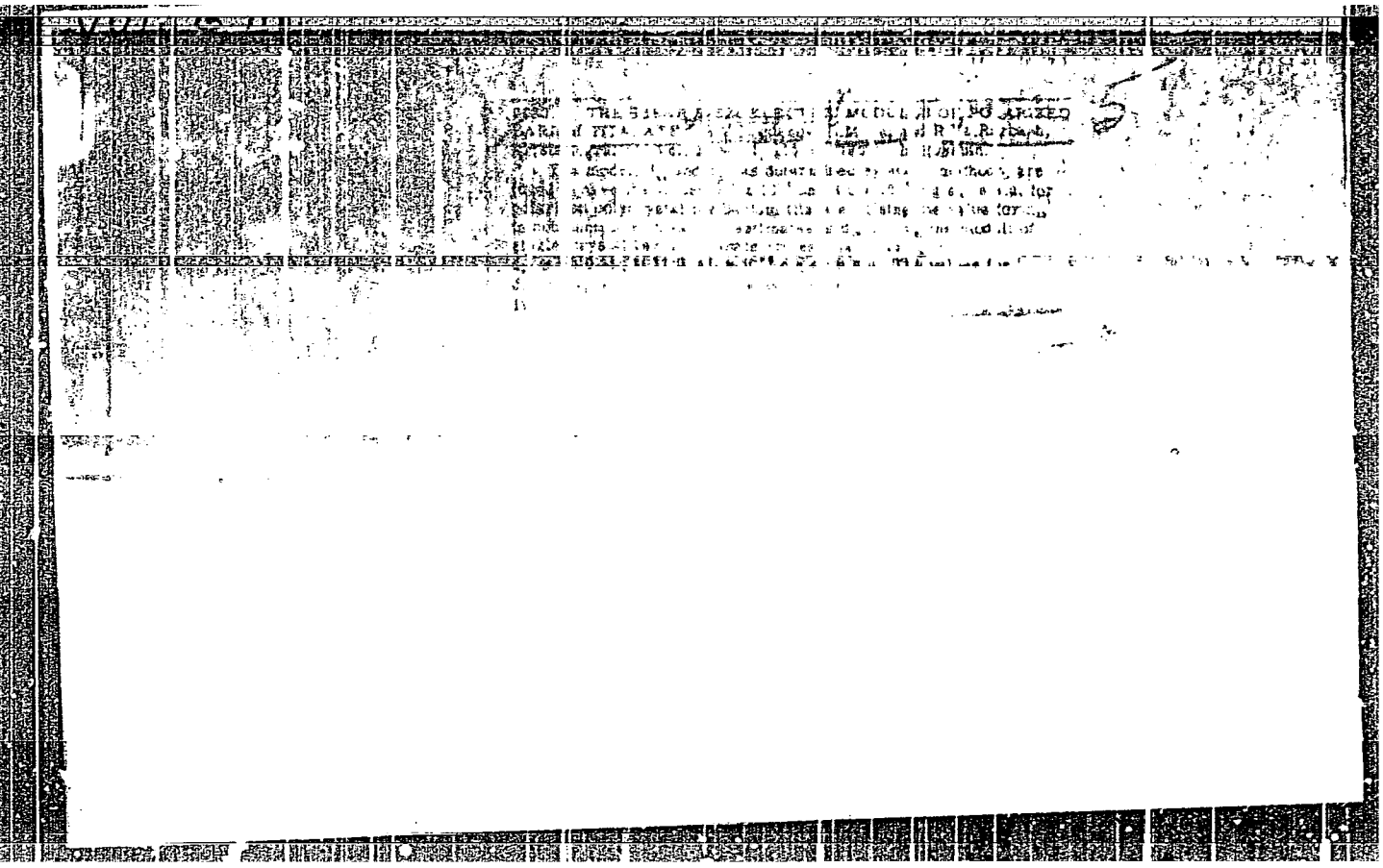
The principal forms of breakdown in electron-hole-transitions. The disruptive voltage of germanium diodes at increased temperatures diminishes considerably with increasing temperature. Therefore thermal ionization plays the most important part among the processes which promote breakdown. However, in the case of diodes of low resistance germanium, the disruptive voltages depend in a wide range of temperature only little on temperature and increase with rising temperature. With these electrodes the increase of the number of electrons mainly takes place in form of collision ionization. Thus it is possible to distinguish between a thermal and a dielectric form of breakdown both in the case of semiconductors and in that of dielectrica. The diodes of germanium with an increased specific resistance (order of magnitude 10 ohm.cm) have a smaller disruptive voltage for parallel current than for current pulses. By improving heat transfer it is possible to increase disruptive voltage. However, the dependence of disruptive voltages on temperature and on the conditions of heat transfer is not so marked in the case of these diodes as in the case of purely thermal breakdown. It may be that breakdown is brought about by the simultaneous effect of thermal- and collision ionization ("thermoelectric breakdown").

Zurn.techn.fis,26,fasc.11, 2403-2416 (1956) CARD 2 / 2 PA - 1678

Thermal breakdown: At first the bases of the elementary theory are recalled to memory after which they are augmented by taking the following additional factors into account: Influence exercised by the resistance R which is independent of temperature; influence of additional amperage which is independent of voltage; influence of additional losses which are independent of counter-voltage; influence exercised by the heat conductivity of the crystal.
Electric breakdown: was found to occur in pure form in the case of parallel voltage only with diodes of low-resistance germanium, but in the case of pulse-like tests it was found in germanium of any resistance. Electric breakdown is caused on the occasion of electron-hole transitions as well as in gases by collision ionization. The computation of the conditions of breakdown is sketched out.
Thermoelectric breakdown: Already before thermal breakdown is about to occur it is possible that the amperage increases considerably because of ionization if field strengths in the electron-hole-transition are high. This increases heating of the diode and thus also thermal ionization in it. The electrons liberated by thermal ionization participate in collision ionization, and, if intensity is sufficient, the common effect exercised by thermal- and collision ionization may lead to the destruction of the state of equilibrium, and to breakdown.

INSTITUTION: Moscow Physical Institute of the Academy of Science.





AUTHOR VUL, B.M., VAVILOV, V.S., SMIRNOV, L.S., GALKIN, G.N., PATSKEVICH, V.M., SPITSYN, A.V.

TITLE On the transformation of the energy of β-particles into electric energy in germanium crystals with P-N transitions. (O preobrazovanii energii β-chastits v electroenergiyu v kristallakh germaniya s P-N-perekhodami.- Russian)

PERIODICAL Atomnaya Energiya 1957, Vol 2, Nr 6, pp 533-537 (USSR).

ABSTRACT In 1955 the authors carried out experiments in the determination of the degree of efficiency of the transformation mentioned in the title. The P-N transitions were obtained by the melting of indium. $Sr^{90} - Y^{90}$ preparations served as sources of β-particles. The total activity of the primary radioactive preparations amounted to 50,100, and 200 millicuries. As source of β-particles strontium sulphate tablets with 50 and 100 millicurie and strontium carbonate tablets with 200 millicurie were used. A diagram shows the β-spectra of these sources. Also measurements during irradiation of a semiconductor with artificially accelerated electrons (400 to 1150 keV) were carried out. The degree of efficiency

CARD 1/3

CARD 2/3

89-6-7/24

On the transformation of the energy of β-particles into electric energy in germanium crystals with P-N transitions.

the degree of efficiency of the transformer diminishes. Further details are mentioned.
(With 8 Illustrations)

ASSOCIATION: not given.
PRESENTED BY: -
SUBMITTED: 18.1. 1957.
AVAILABLE: Library of Congress.

CARD 3/3

USSR/Electricity - Dielectrics G-2

Abs Jour : Ref Zhur - Fizika, No 1, 1958, 1290

Author : Bogdanov, S.V., Vul, B.M., Timonin, A.M.

Inst : Physics Institute, Academy of Sciences, USSR, Moscow

Title : Connection Between the Dielectric, Piezoelectric, and Elastic Properties of Polycrystalline Ceramics and Monocrystals.

Orig Pub : Izv. AN SSSR, ser. fiz., 1957, 21, No 3, 374-378

Abstract : A general method is proposed for calculating the tensors of the dielectric constant, the piezomoduli, and the elastic constants of polycrystalline materials from corresponding characteristics of the initial monocyrstals, a method based on averaging the equations of the piezoelectric converter, which is a generalization of the work by B.M. Vul (Vestn. informatsii BNT MV, 1951, 3, 15), M.Ya.

Card 1/3

constant of the ceramic form are calculated in general.

Abs Jour : Ref Zhur - Fizika, No 1, 1958, 1290

constants, while at $\theta = 55^0$ such anisotropy should be experimentally observed. By comparison with experimental results, the authors conclude that the change in the direction of the polar axis of the single crystals upon polarization is essentially at an angle of 180°.

USSR/Electricity - Dielectrics G-2

Abs Jour : Ref Zhur - Fizika, No 1, 1958, 1277

Author : Vul, B.M.

Inst : Physics Institute, Academy of Sciences, USSR

Title : Nonlinear Properties of Ferroelectrics.

Orig Pub : Izv. AN SSSR, ser. fiz., 1957, 21, No 3, 379-381

Abstract : The nonlinear properties of ferro-ceramics above the Curie point can be characterized quantitatively by the value of the coefficient (β) of P^3, which represents the field intensity E in the form of a power series in the polarization P. The value of this coefficient can be obtained from measuring the equivalent or reversive dielectric constant (ε). Changes of the equivalent were made with a Schering bridge at 50 cycles for different temperatures. They have shown that β depends

Card 1/2

Card 2/2

SUBJECT USSR / PHYSICS
AUTHOR VUL,B.M., SOTOV,A.P.
TITLE The Surface Discharges on Electron-Hole Transitions.
PERIODICAL Žurn.techm.fis.27,fasc.1,211-212 (1957)
Issued: 2 / 1957

On the boundary of the electron-hole transition on the surface of the semiconductor breakdown is complicated by a boundary effect. The surrounding medium is able to limit breakdown voltage considerably if on the surface of the diode "overlapping" (i.e. a surface discharge at a voltage that is lower than the breakdown voltage of the electron-hole transition in the interior of the semiconductor) occurs. In the case of constructions encountered in practice the electron-hole transition is located in a gaseous medium at atmospheric - or lower - pressure. For gaseous media there exists a minimum breakdown voltage below which no electric breakdown can occur in this gas. For air the minimum breakdown voltage amounts to U_{min} = 330 V and to this belongs also the value pd ~ 6, Here p denotes the pressure in mm_{torr} and d - the distance between the electrodes in mm. In the case of diodes in which the breakdown voltage of the electron-hole transition in the interior of the sample is less than U_{min}, overlapping can therefore not occur at all gas pressures. On the other hand, overlapping can prevent total utilization of the possibilities of the diode in the case of diodes in which the breakdown voltage of the electron-hole transition is more than U_{min}.

The measurements carried out by the authors showed that what has just been said is true. In the case of diodes with a breakdown voltage of less than 300 - 400 MeV this breakdown voltage remains constant at any air pressure. Measurements were carried out on diodes which were not mounted in cartridges, and also in such diodes into the cartridges of which holes had been bored.
In diodes with an average breakdown voltage of 400 MeV at normal pressure a surface discharge occurs at diminished air pressure approximately at those values of pd which correspond to the voltage U_{min}. In the case of a further decrease of air pressure the surface discharges cease. Frequently the properties of the diode are deteriorated considerably by the surface discharges. On the occasion of the practical construction of high-voltage diodes it is obviously necessary, when selecting the medium surrounding the electron-hole transition, to take care that overlapping voltage is greater than the breakdown voltage of the electron-hole transition in the interior of the semiconductor.
The above is a translation of this short report.

INSTITUTION: Physical Institute "P.N.LEBEDEV" of the Academy of Science in the USSR

V. L. B. M.

57-10-1/33

AUTHORS: Vul, B. M., and Shotov, A. P.

TITLE: On the Edge Breakdown of p–n Junctions in Germanium (O krayevom proboye p–n–perekhodov v germanii).

PERIODICAL: Zhurnal Tekhn. Fiz., 1957, Vol. 27, Nr 10, pp. 2189–2194 (USSR).

ABSTRACT: The breakdown potentials of diffusion junctions (transition) and melted-in p^+n^- and n^+p^- junctions were measured in air and in media with an increased dielectric constant. It is shown, that the dielectric constant has a marked influence on the breakdown potentials of the p^+n^- junctions and that it plays an important rôle in the breakdown of the p^+n^- and of the diffusion junctions. The observed phenomena can be explained with the assumption, that the surface of the germanium carries a positive charge and that the medium determines the effectiveness of the surface charge.
There are 5 figures, 1 table and 3 Slavic references.

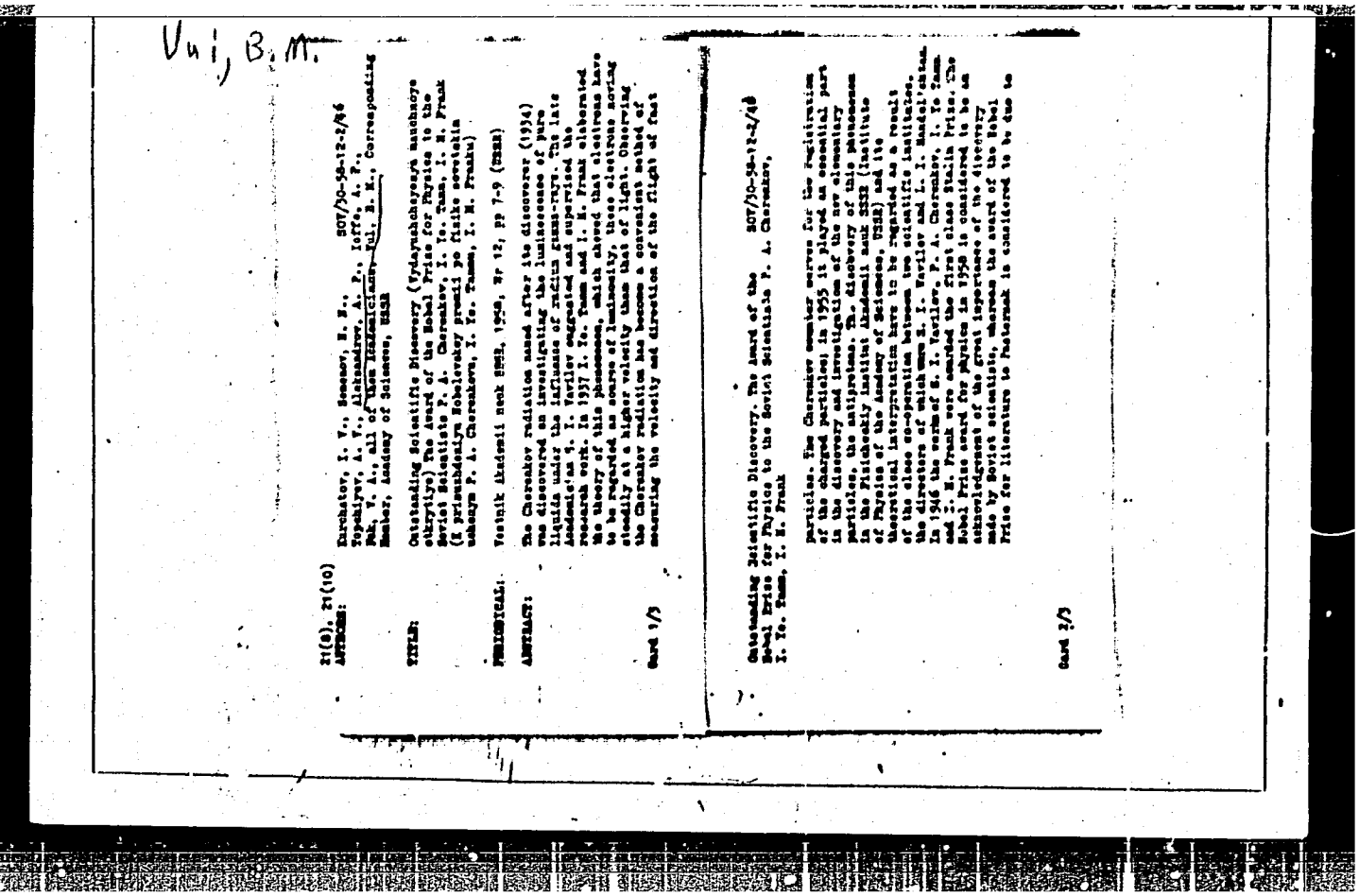
ASSOCIATION: Physical Institute imeni P. N. Lebedev AN of the USSR, Moscow (Fizicheskiy institut imeni P. N. Lebedeva AN SSSR, Moskva).

~~Card 1/2~~

VUL, B. M.,

"Multiplication of Electrons and Holes in p-n Junctions," paper submitted at the International Conference on Solid State Physics in Electronics and Telecommunications - Brussels, Belgium, 2-7 June 1958.

Physical Institute of the Academy of Sciences, Moscow.



Vuj, B. M.

21(8), 21(10)
AUTHORS: Cherenkov, P. A., Corresponding Member, Academy of Sciences, USSR; Tamm, I. Ye., Doctor of Physical and Mathematical Sciences; Frank, I. M., Doctor of Physical and Mathematical Sciences

TITLE: Outstanding Scientific Discovery (Vydayushchiyesya nauchnoye otkrytiye) The Award of the Nobel Prize for Physics to the Soviet Scientists P. A. Cherenkov, I. Ye. Tamm, I. M. Frank (K prisuzhdeniyu Nobelevskoy premii po fizike sovetskim uchenym P. A. Cherenkovu, I. Ye. Tammu, I. M. Frank)

PERIODICAL: Vestnik Akademii nauk SSSR, 1958, Nr 12, pp 7-9 (USSR)

ABSTRACT: The Cherenkov radiation named after its discoverer (1934) was discovered on investigating the luminescence of pure liquids under the influence of radio gamma-rays. The late Academician S. I. Vavilov suggested and supervised the research work. In 1937 I. Ye. Tamm and I. M. Frank elaborated the theory of this phenomenon, which showed that electrons have to be regarded as source of luminosity, these electrons moving steadily at a higher velocity than that of light. Observing the Cherenkov radiation has become a convenient method of measuring the velocity and direction of the flight of fast

Card 1/3

Outstanding Scientific Discovery. The Award of the Nobel Prize for Physics to the Soviet Scientists P. A. Cherenkov, I. Ye. Tamm, I. M. Frank

SOV/30-58-12-2/48

particles. The Cherenkov counter serves for the registration of the charged particles; it played an essential part in the discovery and investigation of the new elementary particles, the antiprotons. The discovery of this phenomenon in the Physical Institute Academii nauk SSSR (Institute of Physics of the Academy of Sciences, USSR) and its theoretical interpretation have to be regarded as a result of the close co-operation between two scientific institutes, the directors of which were S. I. Vavilov, P. A. Cherenkov, I. Ye. Tamm and I. M. Frank were awarded the first class Stalin Prize. In 1946 the name of S. I. Vavilov, P. A. Cherenkov, I. Ye. Tamm and I. M. Frank were awarded the first class Stalin Prize. The Nobel Prize award for Physics in 1958 is considered to be an acknowledgment of the great importance of the discovery made by Soviet scientists, whereas the award of the Nobel Prize for literature to Pasternak is considered to be due to

Card 2/3

AUTHORS: Vul, B. M., Sagal, B. I. 57-28-4-1/33

TITLE: On the Theory of Electron-Hole Transitions in Semiconductors (K teorii elektronno-dyrochnykh perekhodov v poluprovodnikakh)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 4, pp. 681-690 (USSR)

ABSTRACT: Reference is made here to the formula $\frac{d^2u}{dx^2} - \mathrm{sh}\, u = -f(x)$ ... (1.1) by W. Shockley (Ref. 1). This approximate equation is here investigated under the following assumption: Instead of the boundary case studied by Shockley, where the space charge is only produced at the expense of ionized admixtures, it is assumed here that sh u = u, i.e. that the equation (1.1) is investigated in the form of

$$\frac{d^2u}{dx^2} - u = -f(x) \quad (1.4)$$

with maintenance of the boundary condition (1.3), that is to say, that u in the case of $x = \pm\infty$ is limited. The solution of (1.4) with the condition (1.3) in the form of (4.3) is derived. Now it is determined under what conditions the solution (4.3) can approximately replace the exact solution (1.1) under the

Card 1/2

On the Theory of Electron-Hole Transitions in Semiconductors 57-28-4-1/30

condition (1.3). It is shown that this is the case in the entire domain of $-\infty < x < \infty$ when A (a nondimensional positive constant) is sufficiently small. On that occasion (a dimensionless positive constant) can be of any arbitrary value. In the case of a small excess concentration of the admixtures the potential quantity remains small also in the case of any x-value. Therefore $\frac{eh}{u} \ll 1$, and equation (1.4) is everywhere a good approximation for equation (1.1). In the modern semiconductor-devices $A > 1$. Therefore other conditions for the usefulness of the linear approximation which hold in the limited intervals also when $A > 1$ are examined for the domain $-\alpha \leq x \leq \alpha$... (6.1) and $-m\alpha < x < \alpha$ $m > 1$. ...(7.1). The equations (6.7) for the first and (7.7) for the second case are obtained. From these follows that they - (6.7) or (7.7) - according as $m \leq 1$ or > 1 serve as criterion for the usefulness of the linear approximation (4.3) instead of the exact solution (1.1) with the limiting conditions (1.3) in the domain of $-n\alpha \leq x \leq n\alpha$ $(n > 0)$. There is 1 reference, 0 of which is Soviet.

Card 2/3

Physics Inst im P. N. Lebedev

Vul, B. M.

21(0),24(0) PHASE I BOOK EXPLOITATION SOV/32..

Akademiya nauk SSSR. Fizicheskiy institut

Issledovaniya po eksperimental'noy i teoreticheskoy fizike; [sbornik] (Studies on Experimental and Theoretical Physics; Collection of Articles) Moscow, Izd-vo AN SSSR, 1959. 304 p. Errata slip inserted. 2,300 copies printed.

Ed.: I. L. Fabelinskiy, Doctor of Physical and Mathematical Sciences; Eds. of Publishing House: A. L. Chernyak and V. G. Berkgaut, Tech. Ed.: Yu. V. Rylina; Commission for Publishing the Collection in Memory of Grigoriya Samuilovich Landsberg: I. Ye. Tamm (Chairman), Academician; M. A. Leontovich, Academician; P. A. Bazhulin, Doctor of Physical and Mathematical Sciences; S. L. Mandel'shtam, Doctor of Physical and Mathematical Sciences; I. L. Fabelinskiy, Doctor of Physical and Mathematical Sciences; F. S. Landsberg-Barysnanskaya, Candidate of Physical and Mathematical Sciences; and G. P. Motulevich (Secretary), Candidate of Physical and Mathematical Sciences.

PURPOSE: This book is intended for physicists and researchers engaged in the study of electromagnetic radiations and their role in investigating the structure and composition of materials.

COVERAGE: The collection contains 30 articles which review investigations in spectroscopy, sonics, molecular optics, semiconductor physics, nuclear physics, and other branches of physics. The introductory chapter gives a biographical profile of G. S. Landsberg, Professor and Head of the Department of Optics of the Division of Physical Technology at Moscow University, and reviews his work in Rayleigh scattering, combat gases, spectral analysis of metals, etc. No personalities are mentioned. References accompany each article.

Card 2/5

VAVILOV, V.S.; VUL, B.M.; GALKIN, G.N.; FRIDMAN, S.A.

Performance of "atomic" sources of current with double transformation of energy. Fiz.tver.tela 1 no.5:826-827 My '59.
(MIRA 12:4)

1. Fizicheskiy institut im. P.N. Lebedeva.
(Semiconductors)

8(3)

SOV/105-59-10-4/25

AUTHORS: Bagayev, V. S., Vul, B. M., Zherebtsova, A. A., Yuditskiy, S. B.

TITLE: Investigation of Large Germanium Rectifiers

PERIODICAL: Elektrichestvo, 1959, Nr 10, pp 21-26 (USSR)

ABSTRACT: This article presents the results of an investigation of large germanium rectifiers of the VG type which were made by the Vsesoyuznyy elektrotekhnicheskiy institut im. Lenina (All-Union Electrotechnical Institute imeni Lenin)(Ref 1). Figure 1 shows the section of a VG-10 rectifier. The dependence of the rectified currents upon voltage and temperature was determined at a temperature maintained constant by means of a thermostat. The saturation current was determined by measuring the direct and backward current at voltages of $U \approx \frac{kT}{q}$ and according to the backward branch of the static characteristics (Ref 4). U denotes the voltage in the p-n transition of the rectifier, T the absolute temperature, k the Boltzmann constant, and q the elementary charge. The backward branch of the static characteristics was plotted at two values of heat emission. The investigation yielded

Card 1/3

... is assumed to be the only reason

the following results: (1) The rectified current I_d exhibits a sufficiently large section on the static characteristics for which formula (1) holds. The deviations from this formula occurring at increased current densities result from the occurrence of the electron component of the rectified current, which in turn leads to an additional voltage drop and additional losses. The temperature coefficient of the rectified current in the experiments is in good agreement with that of calculations. It is about 3% for the group of rectifiers under discussion. (2) The saturation current calculated according to the formula (see Table 3) is somewhat higher than those obtained by experiment. (3) The differential capacity of p-n transitions of the investigated rectifiers is inversely proportional to the square root of the voltage applied. This indicates the gradual character of the p-n transitions. (4) The backward currents increase monotonously with increasing backward voltage. (5) The pulsed breakdown voltages of the individual rectifiers approximately agree with those to be expected from the specific resistance of germanium foils. Formula (11) yields excessively high breakdown voltages if the heating of the rectifier is assumed to be the only reason

Investigation of Large Germanium Rectifiers

for the increase in the backward current. Formula (13) holds for the overheating of the diode when breakdown occurs, which approximately agrees with the experimental results. There are 7 figures, 6 tables, and 7 references, 4 of which are Soviet.

SUBMITTED: May 11, 1959

Card 3/3

24(3)
AUTHORS: Basov, N. G., Vul, B. M., Popov, Yu. M. SOV/56-37-2-34/56

TITLE: Quantum-mechanical Semiconductor Generators and -Amplifiers of Electromagnetic Oscillations

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 2(8), pp 587-588 (USSR)

ABSTRACT: In the present "Letter to the Editor" the authors discuss the possibility of using the electron transitions between the conductivity zone (valence zone) and donor (acceptor) impurity levels of a semiconductor for the production of electromagnetic radiation (like in a molecular generator). For the realization of semiconductor generators and -amplifiers it is necessary to provide for such a distribution of electrons (holes) in the corductivity zone (valence zone) that the effective temperature of the conductivity electrons (holes) is negative with respect to the ionized donors (acceptors). Such a semiconductor has negative frequency losses in the case of transitions of electrons (holes) from the conductivity (valence) zone to impurity levels. If such a semiconductor is irradiated with electromagnetic waves, the latter may be amplified; if certain conditions (self-excitation)

Card 1/3

Quantum-mechanical Semiconductor Generators and -Amplifiers of Electromagnetic Oscillations

SOV/56-37-2-54/56

are satisfied, such a device may work as generator. In order to attain negative temperatures, a special impurity ionization mechanism is suggested. This state with negative temperature is maintained during the relaxation time of electrons (holes) with the impurity levels. If the number of impurities is small compared to the number of atoms in the crystal lattice, the life time of the conductivity electrons (holes of the valence zone) τ_2 is large compared to the time τ_1 between the collisions of electrons (holes) with the lattice. τ_2 may be regulated by the impurity concentration. During the period τ_2 the system may be used as a generator or as amplifier of electromagnetic oscillations. A reduction of the surface

Card 2/3

Quantum-mechanical Semiconductor Generators and -Amplifiers of Electromagnetic Oscillations

SOV/56-37-2-54/56

reflection coefficient or of the dimensions of the sample may convert the system from the function as generator to that of an amplifier. The present paper was registered by the Committee of Inventions and Discoveries of the USSR Council of Ministers with priority of July 7, 1958.
There are 3 Soviet references.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk (Physics Institute imeni P. N. Lebedev of the Academy of Sciences)

SUBMITTED: May 18, 1959

Card 3/3

66470

~~24(3), 9(3)~~ 24.7700 SOV/20-129-1-16/64

AUTHOR: Vul, B. M., Corresponding Member, AS USSR

TITLE: On p - n Transitions at Low Temperatures

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 129, Nr 1, pp 61 - 63 (USSR)

ABSTRACT: At sufficiently low temperatures, the concentration of the electrons in the conduction zone and the concentration of the holes in the valence zone becomes very small in comparison to the concentration of the admixture, assuming, that $W_1 \ll kT$ holds for the ionisation energy of the admixtures in the semiconductor (k = Boltzmann constant, T = absolute temperature). At low temperatures the effect of the electrons and holes on the formation of space charge of the p - n transition may be neglected. In this case the following equation for the potential distribution in a step-like p - n-transition in dimensionless quantities is obtained for the onedimensional problem with lacking degeneration:

$$\frac{d^2\psi}{d\xi^2} = -\frac{\nu_d}{1+e^{-\beta+\psi}} - \frac{\nu_a}{1+e^{-\beta-\psi}} \quad \text{if } \xi \geqslant 0$$

Card 1/4

$\frac{d^2\psi}{d\xi^2} = - \frac{\nu'_d}{1+e^{-\beta+\psi}} - \frac{\nu'_a}{1+e^{-\beta-\psi}}$ if $\xi < 0$. The units are defined as follows: Unit of potential $\psi = kT/q$, unit of length ξ = Debye length, unit of concentrations ν_d, and ν_a (ν'_d, and ν'_a) of the donors, and the acceptors respectively in an electronic semiconductor (hole-semiconductor) = intrinsic concentration of the electrons n_i. ε denotes the dielectric constant, q the unit charge. Furthermore it holds that $\beta = (g-2W_i)/2kT$ (g = width of the forbidden zone of energies) and W_i is assumed to be equal for both donors and acceptors. The first terms of the above described two equations correspond to the ionized donors and the second terms to the ionized acceptors. These terms depend on the distribution of the potential in the present case. It was found:

$\frac{\nu_d - \nu_a}{\nu_a} = \frac{\alpha(e^{\psi_d} - e^{-\psi_d})}{1+\alpha e^{-\psi_d}}$. Here it holds that $\alpha = e^{-\beta}$ and ψ_d denotes the value of the potential ψ for $\xi \to \infty$. In germanium,

Card 2/4

$\psi_d = \beta$ for $\xi \to \infty$, $\psi_a = -\beta$ for $\xi \to -\infty$, $\psi_d - \psi_a = 2\beta$, is valid with great accuracy. The solution of the first of the above-mentioned two equations runs as follows:

$\frac{d\psi}{d\xi} = \left[0 - 2\nu_d \frac{e^{\psi}}{1+e^{\psi-\beta}} + 2\nu_a \ln(e^{-\beta} + e^{\psi})\right]^{1/2}$. By taking into account the condition $d\psi/d\xi = 0$ for $\xi \to \infty$ it is found that

$\frac{d\psi}{d\xi} = 2^{1/2}\left[\nu_d\beta - \nu_d\psi + \nu_d \ln(1+e^{\psi-\beta}) + \nu_a \ln(e^{-\beta}+e^{\psi})\right]^{1/2} \simeq \left[2\nu_d(\beta-\psi)\right]^{1/2}$.

In similar way one gets

$\frac{d\psi}{d\xi} = \left[2\nu_a'(\beta+\psi)\right]^{1/2}$ for $\xi < 0$. After some steps of computation: $\psi(\xi) = \beta - (\sqrt{2\beta} - \sqrt{(\nu_d/2)}\,\xi)^2$ is obtained. Therefore the complete potential difference belongs practically to the range $\xi > 0$ for $\nu_a' \gg \nu_d$ and the width of the p - n transitions extends from $\xi = 0$ to that value $\xi = \xi_a$ for which $\psi = \beta$. For the potential difference at the transition, caused by diffusion,

On p - n Transitions at Low Temperatures

$U_d=(g-2W_i)/q \sim g/q$. For g measured in ev U_d in v is numerically equal to the forbidden zone of energies. The width of the p - n transition amounts to

$h=(g-2W_i)^{1/2}\xi^{1/2}/q(2\pi N_d)^{1/2}$ in the absence of external voltage.

At low temperatures most of the admixtures are almost completely ionized in the zone of the p - n transition. The results of the present paper were confirmed by investigations of the capacity of p - n transitions at low temperatures. There are 4 Soviet references.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev of the Academy of Sciences, USSR)

SUBMITTED: August 1, 1959

Card 4/4

VUL, B.M. and VAVILOV, V.S.

"The Capacitance of p-n Junctions at low (helium) Temperatures."

report submitted to the MIT Physical Electronics Conference, 24-26 March 1960.

VUL, B.M. and VAVILOV, V.S.

"Effect of Strong Electric Field on the Absorption Edge in Silicon and on the Recombination Properties of Structure Defects in Silicon."

report submitted to the MIT Physical Electronics Conference, 24-26 March 1960.

Vul', B.M.

PHASE I BOOK EXPLOITATION SOV/4379

Vsesoyuznaya konferentsiya po fizike dielektrikov. 2d, 1958

Fizika dielektrikov; trudy vtoroy vsesoyuznoy konferentsii (Physics of Dielectrics; Transactions of the 2d All-Union Conference on the Physics of Dielectrics) Moscow, Izd-vo AN SSSR, 1960. 532 p. Errata slip inserted. 5,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Fizicheskiy institut imeni P.N. Lebedeva.

Ed. of Publishing House: Ye.L. Starokadomskaya, Tech. Ed.: I.N. Dorokhina; Editorial Board: (Resp. Ed.) G.I. Skanavi, Doctor of Physics and Mathematics (Deceased), and K.V. Filippova, Candidate of Physics and Mathematics.

PURPOSE: This collection of reports is intended for scientists investigating the physics of dielectrics.

COVERAGE: The Second All-Union Conference on the Physics of Dielectrics held in Moscow at the Fizicheskiy institut imeni P.N. Lebedeva (Physics Institute imeni P.N. Lebedev) in November 1958 was attended by representatives of the principal scientific centers of the USSR and of several other countries. This collection contains most of the reports presented at the conference and summaries of the discussions which followed. The reports in this collection deal with dielectric properties, losses, and polarization, and with specific inductive capacitance of various crystals, chemical compounds, and ceramics. Photo-electrets, ferroelectric crystals, and various radiation and irradiation effects on dielectrics are investigated. The volume contains a list of other papers presented at the conference dealing with polarization, losses, and breakdowns of dielectrics, which were published in the journal Izvestiya AN SSSR, seriya fizicheskaya, No. 1 and 2, 1960. No personalities are mentioned. References accompany each report.

86450

9,4330 (also 1043)
26.1631

S/181/60/002/011/040/042
B006/E060

AUTHOR: Vul, B. M.

TITLE: Impact Ionization and Tunnel Effect in Semiconductors

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 11, pp. 2961-2967

TEXT: The present paper offers a discussion, based on theory, of the impact ionization in p-n junctions, of low-temperature breakdown, and of the tunnel effect in p-n junctions. The first publications in this field are by A. F. Ioffe. It is pointed out that the elementary theory of impact ionization in semiconductors is in a certain way simpler than in gases, this being chiefly due to the fact that in gases the two partners concerned - electrons and ions - have a very different mobility, whereas it is practically the same in semiconductors (electrons and holes). On the basis of the Townsend theory, the condition $\int_0^h \alpha\, dx = \ln k/(k-1) = \text{const}$ must be satisfied for the breakdown of a p-n junction; $k = \beta/\alpha$; α - coefficient of impact ionization of an electron, β - that of a hole. The maximum electric field strength E_{max} at the junction is equal to $2u/h$, where u is

Card 1/4 3

Impact Ionization and Tunnel Effect in Semiconductors

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the voltage at the junction and h the thickness of the junction layer. The α-values obtained theoretically and experimentally are intercompared in tables for different E-values. The following was obtained for germanium: $\alpha = 10^{-25}E^{5.5}$ cm^{-1}, and $\beta = 2.10^{-25}E^{5.5}$ cm^{-1}, while for silicon $\alpha = 1.4 \cdot 10^{-22}E^{4.7}$ cm^{-1}, and $\beta = 0.31 \cdot 10^{-22}E^{4.7}$ cm^{-1}. Hence the dependence of impact ionization on the field strength is more strongly marked in germanium than in silicon. At temperatures near the absolute zero point, impact ionization may be also observed in homogeneous semiconductors. If the most favorable conditions for impact ionization are provided in, say, germanium, i.e., low ionization energy (which is only about 10^{-2} ev for impurities of the 3rd and the 5th group in Ge) and a large mean free path an impact ionization may be brought about already at exceedingly low field strengths (some v/cm in Ge). The current density as a function of E for homogeneous p-type germanium is shown in Fig. 2, based on data by Zavaritskaya. The curve shows that impact ionization appears at about 5 v/cm, while at 20 v/cm the impurities are practically ionized completely. The ionization of impurities took place solely by holes at this low-temperature breakdown (in n-type, analogously, by electrons only).

Card 2/4

86450

Impact Ionization and Tunnel Effect in Semiconductors

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The possibility is finally discussed of explaining the breakdown of a p-n junction by the tunnel effect. The position of the Fermi levels and the characteristics of an Esaki diode are discussed in great detail. Fig. 3 shows the position of the Fermi levels for a p-n junction in a degenerate semiconductor with thermal equilibrium (a), a maximum direct current (b), and a minimum direct current (c). Fig. 4 illustrates the dependence of the current on the voltage at a tunnel diode on the basis of data by A.P. Shotov. I. I. Ivanchik calculated a p-n junction in a degenerate semiconductor. L. V. Keldysh and V. A. Chuyenkov are mentioned. There are 4 figures, 3 tables, and 11 references: 8 Soviet, 1 British, and 2 US.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR Moskva (Institute of Physics imeni P. N. Lebedev AS USSR, Moscow)

SUBMITTED: August 4, 1960

~~Legend to Fig. 4: 1) reverse branch, 2) direct branch, n) impurity concentration~~

Card 3/3

VUL, B.M.; ZAVARITSKAYA, E.I.

Capacitance of p - n junctions at low temperatures. Zhur. eksp. i teor. fiz. 38 no.1:10-17 Jan '60. (MIRA 14:9)
(Materials at low temperatures) (Junction transistors)

S/053/60/071/004/004/004
B004/B056

AUTHORS: Vul, B. M., Konorova, Ye. A., Demeshina, A. I.

TITLE: Georgiy Ivanovich Skanavi (Deceased)

PERIODICAL: Uspekhi fizicheskikh nauk, 1960, Vol. 71, No. 4, pp. 681 - 685

TEXT: On November 11, 1959 G. I. Skanavi, a prominent Soviet research scientist in the field of dielectrics died. He was Head of the laboratoriya fiziki dielektrikov Fizicheskogo instituta im. P. N. Lebedeva AN SSSR (Laboratory of Physics of Dielectrics of the Institute of Physics imeni P. N. Lebedev of the AS USSR) and Professor of the Moskovskiy gosudarstvennyy universitet im. Lomonosova (Moscow State University imeni Lomonosov). Skanavi finished his studies at the Leningradskiy politekhnicheskiy institut (Leningrad Polytechnic Institute) in 1931, and began working at the plant "Elektrosila", where he had already given proof of his abilities of a research worker in the works laboratory. In 1935 he entered the Nauchno-issledovatel'skiy institut radiopromyshlennosti (Scientific Research Institute of the

Card 1/3

Radio Industry), and in 1940 he began his activities at the Institute of Physics imeni B. N. Lebedev of the AS USSR, first in the capacity of senior scientific worker, and later as deputy of the Head of the elektrofizicheskaya laboratoriya (Electrophysical Laboratory), and since 1954 as Head of the Laboratory of the Physics of Dielectrics, which became the leading laboratory in this field of the Soviet Union. The first works (1931-1935) of the deceased dealt with the high-voltage insulation of electrical machines. His method of removing the corona, and his method of testing insulation were used in industry. Skanavi became Candidate of Physical and Mathematical Sciences in 1937. Many of his works dealt with the dielectric losses and with polarization in glasses. Skanavi drafted the theory of relaxative losses, and discovered the neutralization- and crystallization effect of loss reduction. During the war he investigated polycrystalline dielectrics at the Institute of Physics, produced new dielectrics with a high dielectric constant, and developed a theory, which explains the high dielectric constant of crystals. It was upon these works that the Doctor's dissertation defended by him in 1946 was based. For the industrial production of ceramic capacitors developed by him, he was awarded the Stalin Prize

Georgiy Ivanovich Skanavi (Deceased)

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B004/B056

in 1952. In recent years Skanavi, assisted by the collaborators of his laboratory, produced dielectrics with a particularly high dielectric constant: the strontium-bismuth-titanates. In 1958 the first strontium-titanate single crystals were obtained at his laboratory. During the investigation of the electric strength of dielectrics the photoconductivity of KBr crystals stimulated by high voltage pulses was discovered. Further, Skanavi delivered the glass substances known as "pyroceram" with finely disperse crystalline phase and a new class of electrets. Besides his scientific activities, Skanavi was for several years the Head of the works laboratory of a radiotechnical factory in Moscow. He published more than 70 scientific works, among them the monograph "Fizika dielektrikov" in two volumes. For several years Skanavi was the scientific secretary of the Institute of Physics, and Member of the Byuro otdeleniya fiziko-matematicheskikh nauk AN SSSR (Bureau of the Branch of Physical and Mathematical Sciences of the AS USSR). Since 1944 Skanavi has been Member of the Communist Party of the Soviet Union, and since recently also Secretary of the Party Committee of the Institute of Physics. There are 1 figure and 55 Soviet references.

Card 3/3

9,4300 (3203, 1043, 1143)
24.7700 2407, 1035, 1135

S/020/60/135/006/012/0[illegible]
B019/B056

AUTHORS: Vul, B. M., Corresponding Member AS USSR, Zavaritskaya, E. I., and Keldysh, L. V.

TITLE: Impurity Conductivity of Germanium at Low Temperatures

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 135, No. 6, pp. 1361-1363

TEXT: At temperatures $T \ll \varepsilon_i/k$, where ε_i is the impurity ionization energy and k the Boltzmann constant, the electrical conductivity of semiconductors is very low. If the field strength is increased, the impact ionization increases, because the mean free path of the carriers is relatively great at low temperatures. As the impurity ionization energy is low (0.01 ev for the indium-doped p-type germanium considered here), impact ionization starts already at field strengths of some v/cm. The lower the temperature, the lower is the fraction of thermal ionization, as follows from the dependence of current density on field strength shown in Fig. 1. At the temperature of liquid helium, the hole concentration may be

Impurity Conductivity of Germanium at Low Temperatures

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B019/B056

described by: $p = \frac{s(N_a - N_d) - rN_d}{r + s}$ (1), where s is the mean ionization probability, r the mean recombination probability, N_a the acceptor concentration, and A_d the donor concentration. As the increase in r with an increase of electron energy is much slower than that of s, the free hole concentration in the range of pre-breakdown field strength is determined largely by the exponential growth of the ionization rate. The drift rate as a complex function of field strength is discussed, and it is found that at high field strengths the sharp decrease in mobility at helium temperatures is connected with the occurrence of a large quantity of charge centers. Thereby, the fraction of Coulomb scattering in the total number of collisions per unit time increases. The authors thank V. A. Chuyenkov for a discussion. There are 3 figures and 6 references: 3 Soviet and 3 US.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev of the Academy of Sciences USSR)

SUBMITTED: August 31, 1960

Card 2/2

89288
S/181/61/003/001/027/042
B102/B204

24.7800 (1142, 1395, 1469)

AUTHOR: Vul, B. M.

TITLE: Capacity characteristics of p-n junctions

PERIODICAL: Fizika tverdogo tela, v. 3, no. 1, 1961, 204-205

TEXT: The present paper deals with the derivation of some formulas for calculating the capacity of p-n junctions. The capacity of a p-n junction depends on the ionized-impurity distribution in it. For clarifying the principal relations, it suffices to study the simple case of a plane junction, in which the one side, e.g., the p-type, has such a low resistance that the entire resistance may be ascribed to the n-type side. In this case, the potential distribution in the junction may be described by the Poisson equation $d^2\psi/dx^2 = -4\pi\rho/\varepsilon$, where $\rho = f(x)$ is the volume charge density, and x is the distance of the point of reference in the n-type region from the junction surface. With the boundary conditions $\psi(0) = \left.\frac{d\psi}{dx}\right|_{x=h} = 0$, $U = \psi(x)_{x=h} = \frac{4\pi}{\varepsilon}\int_0^h xf(x)dx$ is the solution,

Card 1/4